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Geological Survey of the State of New York.

PALÆONTOLOGY: of New York

Vol. V. Part I.

LAMELLIBRANCHIATA
I.

TEXT AND PLATES.

CONTAINING DESCRIPTIONS AND FIGURES
OF THE
MONOMYARIA
OF THE
UPPER HELDERBERG, HAMILTON AND CHEMUNG GROUPS.

By JAMES HALL,
STATE GEOLOGIST.

ALBANY, N. Y.:
CHARLES VAN BENTHUYSEN & SONS.
1884.

STATE OF NEW YORK,
ALBANY, *February* 15, 1884.

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DEDICATION.

To His Excellency
GROVER CLEVELAND,
Governor of the State of New York:

Sir — I have the honor to present to your Excellency a new volume of the Natural History of the State of New York, forming a continuation of the work on the Palæontology of the State.

This volume, together with another to be published early next year, is devoted to the description and illustration of the fossil bivalve shells known as Lamellibranchiata. The entire work will embrace all the fossils of this class from the higher geological formations of the State. The material has been accumulated from various sources during the period since 1843. Eighty plates for these volumes had already been lithographed in 1873, but the publication was delayed for want of legislative authority for the printing. During the session of 1883 an act was passed by the Legislature, and sanctioned by your Excellency, providing for the completion of the entire work upon the Palæontology of the State. The present volume is the first fruit of that act, and I trust its publication may give you personal satisfaction.

Hoping that this volume may commend itself to the students of science and prove not unworthy of the great series of works comprised in the Natural History of the State of New York,

I have the honor to be,
With great respect,
Your obedient servant,
JAMES HALL,
State Geologist.

Albany, *February* 15, 1884.

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ADDENDA AND CORRIGENDA.

Page 14, add to reference of A. LAUTUS, plate 81, fig. 5.
Page 30, for *A. elongatus* read *A. celsus.*
Page 54, add to reference of L. PRIAMUS, plate 82, fig. 6.
Page 74, line 2, for LXXXI read LXXXII.
Page 82, line 3, for *P. crenulatus* read *C. crenulatus.*
Page 114, line 23, for *recticulata* read *reticulata.*
Page 157, line 11, for anterior read posterior.
Page 167, for *A. Bigsbyi* read *L. Bigsbyi.*
Page 220, line 8, for N. Y. read Pa.
Pages 186 and 238, lines 4 and 7, respectively, for Alleghany read Cattaraugus.

The names Philipsburgh and Rockville, are localities referred to in the earlier Geological Reports, from which many fossils were obtained. The former (Philipsburgh) is now known as Belmont. Rockville was a settlement near the mouth of Rock creek on the Genesee, in the township of Belfast, during the construction of the Genesee Valley Canal. The name does not now appear in the Gazetteer.

PREFACE.

The present volume includes the letter press and plates which constitute a portion of Volume V, Part 1, of the Palæontology of New York. It was originally intended to arrange the whole of this material as a volume of text and a volume of plates; but the exigencies of publication have made it necessary to issue a volume of the work at the present time, and in its present form, leaving the remaining portion to constitute a similar volume which will be published early in the next year.

The entire work will embrace the descriptions and figures of all the recognized forms of Lamellibranchiata from the Upper Helderberg, Hamilton, Portage and Chemung Groups within the limits of the State of New York. This volume includes descriptions and figures of the species under the genera included in the accompanying synopsis, belonging to the families, Pectenidæ, Pterinidæ, Aviculidæ, Ambonychidæ, and Mytilidæ.

The fossil Lamellibranchiata of the higher groups of the New York geological series are often abundant, of great variety of form and of very interesting character. Our earlier knowledge of these fossils is almost wholly due to Mr. Conrad, who described eleven species in the Annual Report of the Geological Survey in 1838; and during the following years this work was continued, both in the Annual Reports of the Survey and in the Journal and Proceedings of the Academy of Natural Sciences of Philadelphia. The total number of species described by Mr. Conrad from all the groups is about one hundred and ten, and fifty of these have been illustrated in the publications of the Academy. The number of species at present known from the same formations is about 600, of which nearly 500 are from the groups above the Oriskany sandstone.

During and since this period the writer has made extensive collections of these fossils, both with his own hands and through the agency of his assistants, preparatory for their illustration in the PALÆONTOLOGY OF NEW YORK. After having accumulated considerable collections, and feeling the importance of their proper identification, the writer personally engaged Mr. Conrad to examine the whole and to give his determination of the species which he had described. On three several occasions, previous to 1865, Mr. Conrad visited Albany for the express purpose of making these determinations and identifications, labelling one or more of each of those which he recognized as typical forms of the species. Through these means and by later study and comparison it is believed that nearly all the previously described forms have been satisfactorily determined.

The species described in this volume are illustrated from original drawings made from typical or authenticated specimens. These specimens are chiefly selected from the State Museum collections, which were derived from the State Geological Survey, from subsequent acquisition by purchase, or from field collections especially made for this object.

The work of lithographing the plates of the Lamellibranchiata was begun in 1870, and owing to the author's constant occupation in duties pertaining to the State Museum, the supervision of the drawings and lithography were chiefly intrusted to Mr. R. P. Whitfield, who at that time was acting as draughtsman and museum assistant, and the first thirty plates of this volume were drawn, and lithographed, and arranged under his direction.

Unfortunately the species had not, at that time, been critically studied, and in a final revision at a later period (1880) it became necessary to make an arrangement of the genera and species which is not in accordance with the arrangement upon these plates. In the course of the work it has been found necessary to reproduce, in a more correct form, with illustration of the parts, some of the figures of the earlier plates, as well as to give many additional species. All these later illustrations are given on Plates lxxxi–xcii inclusive, which are arranged in systematic order, with the generic forms in their natural relation to each other. It is to be regretted that these plates cannot be arranged in consecutive order with those preceding, but in the earlier part of the work the plates were lithographed, from i to lxxx, for illustrating the material then on hand, and the additional plates can only come in after the latter number. This want of conformity, however, affects only the plates, the text presenting the genera and species in consecutive and systematic order, with cross-references to the newly introduced plates.

The subdivision among those forms which have usually been referred to Aviculopecten was found to be imperatively necessary for any strict classification, and the other subdivisions among generic forms which have indiscriminately been referred to Avicula, Pterinea, Pteronites, etc., have been deemed equally important. In these subdivisions, while the essential internal characters have been regarded as of primary importance, the author, without violating this rule, has endeavored to make such an arrangement of the species that the student may determine the generic relations from the general form and exterior markings alone. Since the fossil Lamellibranchiata are commonly found in an imperfect condition, with the interior surface remaining attached to the matrix, and only in rare examples, or in very favorable conditions, revealing the interior structure, it becomes important to have some means of identification other than that furnished by the hinge characters which are so rarely accessible. However, notwithstanding the general arrangement according to external features, the hinge and the interior structure have by no means been undervalued or neglected, as is shown by numerous illustrations of these parts, which it is believed give an amount of information not before published in any work upon this class of fossils.

The synopsis of genera here presented is given without comment or comparison. In the succeeding volume the author proposes to give a *résumé* of all the genera described, and in the same connection a comparison with genera described in other publications with some notice of the bibliography of this class of fossils, so far as relates to the palæozoic forms. In that notice the reasons for the generic subdivisions proposed in the present volume will be given in full.

In the final revision of the genera and species and in the preparation of the text and the later plates of this volume the author cheerfully acknowledges the very valuable assistance rendered by Mr. Charles E. Beecher.

Of the mechanical and artistic execution of this work I may speak with commendation. Regarding the scientific character of that part of the work already published and its value to the general public, we have had the testimony of prominent scientific men; and I hope the present volume may be regarded as an acceptable contribution to our knowledge of a class of fossils of which little systematic information has heretofore been given.

The author has been indebted for the use of specimens for study and illustration to Dr. James Knapp, of Louisville, Ky., to E. B. Knapp, Esq., of Skaneateles, N. Y., and to Mr. Charles E. Beecher. To the collections of the Cornell University he is indebted for two specimens illustrated in the present volume, and for several others which are illustrated in the plates already prepared for the next volume.

JAMES HALL.

ALBANY, *February*, 1884.

SYNOPSIS
OF THE
CHARACTERS OF THE GENERA
INCLUDED IN
THIS VOLUME.

CLASSIFICATION.

PECTENIDÆ	Pernopecten.	inequivalve.
	Crenipecten.	
	Aviculopecten.	
	Lyriopecten.	
	Pterinopecten.	
PTERINIIDÆ	Pterinea.	
	s. g. Vertumnia.	
	Actinopteria.	
	Ptychopteria.	
AVICULIDÆ	Limoptera.	
	Glyptodesma.	
	Leiopteria.	
	Leptodesma.	
	Pteronites.	
	Palæopinna.	
	Ectenodesma.	
AMBONYCHIIDÆ	Byssopteria.	equivalve.
MYTILIDÆ	Mytilarca s. g. Plethomytilus.	
	Mytilarca.	
	Gosselettia.	
	Modiola s. g. Mytilops.	

Pernopecten, Winchell.* Shell like Pecten. Hinge with a central cartilage pit and a crenulated hinge-plate on each side below the hinge-margin. This and the following genus appear to be more nearly related to the genus Pecten than to Aviculopecten.

Crenipecten, Hall. Like Aviculopecten in form. Hinge furnished with a series of small cartilage pits throughout its entire length. Examples, pl. ix, figs. 12, 15.

Aviculopecten, McCoy, is emended to include those forms which have the hinge-line usually shorter than the transverse diameter, and both ears well-defined. Test ornamented with rays. Example, pl. i, fig. 10.

Lyriopecten, Hall. Differs from the preceding in the short hinge-line and very small anterior ear. Test usually ornamented with strong rays. Example, pl. viii, fig. 8.

Pterinopecten, Hall. Hinge-line long. Ears not well-defined, being simple expansions or extensions of the upper lateral margins to the hinge-line. Test ornamented with rays. Examples, pl. ii, fig. 18; pl. v, fig. 6.

Pterinea, Goldfuss. Shell inequivalve, inequilateral; posterior side alate; anterior end nasute or auriculate. Ligament internal; ligamental area longitudinally striated. Cardinal teeth two or more. Lateral teeth linear oblique. Posterior muscular impression large, situated on the post-umbonal slope. Anterior muscular impression small, situated within the rostral cavity. Test ornamented with rays. Examples, pl. xv, figs. 1–21; pl. lxxxiii, fig. 12.

S. g. Vertumnia, Hall. Differs from Pterinea in having the right valve convex, and the left flat or concave. Hinge area narrow. Example, pl. xxiv, fig. 12.

Actinopteria, Hall. Characterized from Pterinea in the absence of a broad striated ligamental area and strong cardinal and lateral teeth. Right valve sub-convex. Surface with fine rays. Examples, pl. xvii, fig. 26; pl. xviii, fig. 13; pl. xix, fig. 3.

Ptychopteria, Hall. Differs from Actinopteria in the nasute anterior extremity, and large straight wing marked by a strong longitudinal fold. Hinge-line narrow, linear; furnished with one or two linear oblique cardinal and lateral teeth. Surface with fine rays. Example, pl. xxiii, fig. 17.

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* See note, page 81.

Limoptera, Hall. Shell large, inequivalve, inequilateral, subquadrate, strongly alate on the posterior side, auriculate on the anterior end. Ligamental area large, common to both valves, wider in the left valve, longitudinally striate and extending to the cardinal extremities. The hinge has an oblique posterior tooth and several cardinal folds under the beak. Anterior muscular impression very small and deep, situated at the apex of the rostral cavity; posterior impression large. Pallial line simple, formed of a series of small deep pits. Inter-pallial area with numerous small pits for the attachment of umbonal muscles. Test radiated; radii becoming obsolete with age. Examples, pl. xcii, figs. 3, 8, 9.

Glyptodesma, Hall. Shell aviculoid, erect or moderately oblique; inequivalve. Ligament external. Ligamental area striated, continuous. Hinge with two strong lateral teeth, and numerous irregular transverse plications along the cardinal margin. In form the shells of this genus resembles Actinodesma; but it has not the permanent diverging teeth of that genus. Surface marked by concentric striæ. Examples, pl. xi, figs. 3, 4; pl. xiii, figs. 5, 10; pl. lxxxvi, figs. 3, 8.

Leiopteria, Hall. Shell aviculoid, oblique, sub-rhomboidal. Anterior extremity auriculate; wing large, extremity produced. Test without proper rays. Ligament external. Ligamental area marked by fine parallel longitudinal striæ. Hinge with one or two oblique slender lateral teeth. The cavity of the beak is partially separated from the anterior end by a short partition or diaphragm. Examples, pl. xx, fig. 17; pl. lxxxviii, figs. 5, 27.

Leptodesma, Hall. In its prevailing forms it is similar to Leiopteria, except that the anterior end is always nasute and acute instead of auriculate and rounded. Hinge narrow, furnished with a slender lateral tooth just posterior to the beak and nearly parallel to the hinge-line. Ligament external. Ligamental area narrow, extending the entire length of the hinge, marked by fine, sharp, longitudinal striæ. Test with concentric striæ. Examples, pl. xxi, fig. 14; pl. xxii, fig. 21; pl. xc, fig. 28; pl. xci, figs. 9, 16.

Pteronites, McCoy. This genus is restricted to those possessing the characters of the original types. Body very oblique. Hinge-line longer than the body of the shell. Wing and hinge extended posteriorly. Test marked by concentric striæ. Example, pl. xxii, fig. 26.

Palæopinna, Hall. Shell similar in outline to Pinna, gaping in front. Test marked by fine radiating lines. Body more convex and test with finer rays than in the ordinary Pinna. Hinge-line simple. Example, pl. xxv, fig. 18.

Ectenodesma, Hall. Resembles Glyptodesma in outline, except that the anterior wing is more produced and both wings more acute at their extremities. Test ornamented with rays. Example, pl. xxiii, fig. 30.

Byssopteria, Hall. Shell erect, equivalve. Alate posteriorly, truncate, and with a nasute projection in front. Surface radiated. Examples, pl. xxiii, figs. 21, 22; pl. lxxx fig. 11.

Mytilarca, s. g. *Plethomytilus, Hall.* Equivalve, mytiloid, gibbous. Shells with a finely striated ligamental area. Posterior side subalate. Hinge-line transverse. Lateral teeth small, oblique; no cardinal teeth have been observed. Test with concentric striæ. Examples, pl. xxx, figs. 5, 7; pl. xxxi, figs. 2, 3, 7.

Mytilarca, Hall. Shell equivalve, inequilateral and mytiliform with terminal beaks and short hinge-line, which is bordered by a flattened, longitudinally striated, ligamental area of greater or less extent. Cardinal teeth small, situated beneath the beak. Posterior teeth small and oblique, situated at the post-cardinal extremity of the hinge. Test free from radii, with a single known exception. Examples, pl. xxxii, figs. 9, 17, 19, 20.

Gosselettia, Barrois. Shell subtriangular, truncate on the anterior side, subalate on the posterior side. Ligamental area wide, longitudinally striate. Cardinal teeth strong, situated under the beak. Lateral teeth elongate. Surface marked by concentric striæ. Examples, pl. xxxi, figs. 10–16.

Modiola, s. g. *Mytilops, Hall.* The fossils of this genus resemble Modiola and Lithodomus in external form, and may also be compared with the fossil genus Myoconcha. Hinge-line narrow, oblique, extending about one-half the length of the shell. Beaks terminal. Examples, pl. xxxiii, figs. 16, 17; pl. lxxxvii, fig. 9.

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[The heavy-faced figures indicate a description of the species.]

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LAMELLIBRANCHIATA

OF THE

UPPER HELDERBERG, HAMILTON, PORTAGE AND CHEMUNG GROUPS.

DESCRIPTIONS OF SPECIES.

AVICULOPECTEN, McCoy.

Section *a*.

Aviculopecten princeps.

PLATES I, FIGS. 10, 11; V, FIGS. 18, 19, 23, 24; VI, FIGS. 1-9; XXIV, FIG. 7; AND LXXXI, FIGS. 13-17.

Monotis princeps, Conrad. Annual Report N. Y. Geolog. Survey, p. 117. 1838.
Avicula parilis, " Proceedings Acad. Nat. Sci. Phila., vol. 8, p. 239, pl. 112, fig. 9. 1842.
Compare *Aviculopecten Sanduskyensis*, Meek. Proceedings Acad. Nat. Sci. Phila., p. 161. 1871.
" *Avicula parilis*, Conrad? Meek. Palæontology of Ohio, vol. 1, p. 197. 1873.
" *A. pecteniformis*, Conrad. Jour. Acad. Nat. Sci. Phila., vol. 8, p. 240, pl. 12, fig. 14. 1842.
Aviculopecten princeps, (Conrad) Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 5, figs. 18, 19, 23, 24; pl. 24, fig. 7. Jan., 1883.
Aviculopecten Sanduskyensis, (Meek) Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, figs. 10, 11. Jan., 1883.

Shell large, obliquely broad-ovate; axis inclined more than 60° to the hinge-line; length and height nearly equal, varying within moderate limits; anterior margin convex; the convexity increasing to the middle of the postero-lateral side, thence truncated and extending in a straight line to the beak, making an angle of from 30° to 40° with the hinge-line. Valves depressed; left valve regularly convex; right valve nearly flat, or very moderately convex.

Hinge-line straight, having a length of from two-thirds to more than three-fourths the length of the shell, and extending anteriorly as far as the antero-lateral margin with little variation. Beaks obtuse, rounded, anterior to the middle of the hinge. Umbo subtending an angle of about 130°.

Ears large, triangular; posterior one the larger, and defined by the abrupt slope of the side of the umbo, while the anterior ear is separated by a distinct sulcus; lateral margins concave, becoming convex at the hinge-line. Byssal-sinus broad, rounded, well-defined and indicated on the ear by a sulcus extending to the extremity of the beak.

The right valve is flatter and proportionally broader than the left. The limits of the ears are clearly indicated by the rapid slope of the umbo, and the absence of strong radiating lines of ornamentation.

Test thin, marked by numerous regular alternating rays, which increase in number by interstitial additions, and become broader and stronger towards the margins. These radiating ribs are crossed by very fine, sharp striæ of growth. On the ears the rays are nearly obsolete, and the lines of growth are sharper and stronger than on the body of the shell.

The internal mould preserves, in a subdued degree, the ornaments of the exterior, and shows a simple, continuous pallial impression, extending nearly parallel to the margins, and terminating in a large sub-ovate muscular impression, which is posterior to the middle of the shell. The cavity beneath the beak extends over the ligamental area at that point, forming the cartilage-pit. In young individuals the ligamental area shows three or four small furrows at the beak, extending towards the extremities of the hinge-line. Three of these furrows measure 2 mm. across. In larger and older individuals, this furrowed ligamental area is much more marked, having frequently a width of 5 mm., and extends the entire length of the hinge, showing more numerous furrows. At the beaks the furrows are bent slightly outwards, otherwise, with gentle undulations, they run parallel to the hinge line. This feature is a constant character in this and several other species, and is similar to that in many forms of PTERINEA and LYRIOPECTEN.

The dimensions of the shells of this species are very variable. Large individuals have a height of 80 mm. with nearly equal length, and a hinge-line of 50 mm. The gradation from this form is very gradual to those in which the height is equal to, or greater than, the length, and where the length of the hinge-line is nearly equal that of the shell.

This species differs from *A. pecteniformis* by the larger anterior ears, with more numerous and less prominent rays on the body of the shell. In specimens identified as *A. Sanduskyensis* the umbo is more inflated and obtuse, while the length is uniformly greater than the height. *A. scabridus*, which in some respects resembles this species, is clearly distinguished by its characteristic surface-ornamentation and the proportionally greater height of the valves.

This is one of the largest and the most abundant species in the lower and middle portions of the Hamilton group. It is very easily distinguished by the large ears with the furrowed ligamental area, full, obliquely ovate outlines, and characters of ornamentation. It first appears in the Upper Helderberg limestone in western localities. It is abundant in the lower beds of the Hamilton group, especially in the coarser shales of the eastern central part of the State; while it is rare in the upper soft shales of the group, and scarcely ever seen in the western counties.

Mr. Conrad suggests the probable identity of this species with the subsequently described form, *A. parilis.* A careful comparison of a large number of specimens establishes this synonymy, and indicates the propriety of uniting this form with the *A. pecteniformis*, Conrad. *Aviculopecten Sanduskyensis*, Meek, which was afterwards referred by that author to *A. parilis*, Conrad? belongs to this species.

The apparent specific differences noted in the description of these three forms are neither constant nor well defined; nor even to be regarded as marking varieties. They are separately considered for the purpose of referring to the original descriptions, and to correspond with the original specimens, which are figured for two of the species. Farther investigation will probably show more satisfactory proof of the validity of the present conclusions. The original description of Mr. Conrad is as follows — *loc. cit.:*

" *Monotis princeps.*—Shell convex, depressed; ear small, emarginate; radiating striæ numerous; rugose, profound. Length about 3 inches.

" *Locality*, Cazenovia."

Mr. CONRAD'S description of *Avicula parilis* is as follows (*Jour. Acad. Nat. Sci. Phila.*, Vol. VIII, p. 239. 1842):

" *Avicula parilis*, pl. 12, fig. 9.—Upper valve flat; lower valve plano-convex; surface with numerous, equal, filiform, prominent radii; wings angulated at tip, the anterior one most acute, and nearly equal in length to the posterior wing; apex not elevated above the hinge line; anterior, posterior, and basal margins forming an uninterrupted arched or rounded outline.

" *Locality*, Cazenovia, Madison county, New York. Upper Silurian shale.

" A beautiful and common species, the larger valve much resembling a *Pecten*.

" The MONOTIS *princeps*, of the Geological Reports of New York, is probably the same shell.

" The flat valve is represented on the plate."

Formations and localities. In limestone referred to the age of the Upper Helderberg group (Corniferous limestone), at Sandusky, Delaware, and near Columbus, Ohio; and also at the Falls of the Ohio.

In the coarser shales of the Hamilton group, at numerous localities in the eastern and central portions of the State; in the upper soft calcareous shales of the group at Moscow, Livingston county, N. Y., and very rarely in the western extension of the group.

AVICULOPECTEN PECTENIFORMIS.

PLATE I, FIG. 9.

Avicula pecteniformis, CONRAD. Journal Acad. Nat. Sci. Phila., vol. 8, p. 240. 1842.
Aviculopecten pecteniformis, (CONRAD) HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 9. Jan., 1883.

SHELL sub-ovate oblique to the hinge-line; length equal to the height; anterior and basal margins regularly rounded, the body of the shell extending in a nearly straight line from the postero-lateral margin to the beak.

Left valve convex, reaching its greatest convexity at about one-third the length of the valve from the beak.

Hinge-line straight, having a length of more than two-thirds the length of the shell. Umbo prominent, sloping rapidly to the ears; the sides subtending a little more than a right angle. Beak prominent, situated a little anterior to the middle of the hinge.

Ears triangular, unequal, the anterior about one-half the size of the posterior one, lateral margins concave.

Right valve not observed.

Test ornamented by about 35 sharp, strong rays, with intermediate finer ones, which are crossed by fine imbricating striæ of growth. The radii are not present on the ears. Internal characters not shown in the specimen described.

The original of this species has a length of 47 mm. with an equal height. The hinge-line measures 27 mm. The specimen is somewhat imperfect at the extremities of the ears, and the posterior ear is not sufficiently extended in the figure.

This form may be distinguished from *A. princeps* by its smaller anterior ear, and less expansion at the base of the ears. The umbo appears more contracted, and in the single known specimen is more prominent. The principal radii are sharper and stronger, and the alternation of smaller ones more regular.

In *A. exacutus*, which resembles this form, the beaks are nearer the middle of the hinge-line, and the shell has a distinctly reticulate surface ornamentation, with the radii continued over the ears.

The specimen figured is the left valve, and is the original of Mr. Conrad's description, no other specimen having been observed.

Formation and locality. From the corniferous limestone of the Upper Helderberg group, Schoharie, N. Y.

AVICULOPECTEN CLEON.

PLATE I, FIG. 1.

Aviculopecten Cleon, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 1. Jan., 1883. Compare with the young of *A. princeps.*

SHELL small, ovate; transverse axis slightly oblique; length somewhat greater than the height; margins regularly rounded.

Left valve convex, the convexity equal to about one-sixth the length of the hinge-line. The point of greatest convexity is just anterior to the centre of the shell and towards the beak. Right valve not observed.

Hinge-line straight, length five-sixths the height of the entire shell.

Beak anterior to the middle of the hinge, not prominent.

Ears defined by the absence of radiating lines, but not by any marked change in the convexity of the shell; lateral margins concave. The anterior ear is limited by a shallow groove. The posterior ear is about twice the size of the anterior.

Test thin, ornamented by a reticulation of fine radiating lines, and finer concentric striæ of growth. The stronger rays have one or two finer lines between. The lines of growth extend over the ears, but less distinctly than over the body of the shell; and otherwise the ears are nearly smooth.

Interior not observed in the specimen described.

The length of this specimen is 21 mm., height 24 mm., hinge-line 20 mm.

This form resembles the young of *A. princeps,* but it is less oblique, and the ears less strongly defined than in the young of that species as represented in authentic specimens. The figure does not quite represent the form of the specimen, and the posterior ear is not so well defined as is shown in the illustration. The form *A. exacutus* is very similar to this one; but that species has fewer and sharper radiating striæ, and the geological horizons of the two are widely separated.

Formation and locality. Upper Helderberg limestone, Columbus, Ohio.

AVICULOPECTEN SCABRIDUS.

PLATE III, FIGS. 3-12.

Aviculopecten scabridus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 3, figs. 3-12. Jan., 1883.

SHELL large, sub-circular, very slightly oblique to the hinge-line; length somewhat greater than the height; pallial margin circular, becoming very full posteriorly.

Valves depressed, moderately convex.

Hinge-line straight; length equal to two-thirds the length of the shell, marked by a thickening and inflection of the cardinal margins of the ears.

Beaks obtuse, rising slightly above and arching over the hinge-line, situated just anterior to the middle; umbonal angle 110°.

Ears narrow, triangular, indented by a sinus which has a depth equal to the width of the ears. The anterior ear of the left valve is one-half the width of the posterior, but of nearly equal length; in the right valve the ear is larger, and has a well-marked byssal sinus.

The right valve is somewhat less convex than the left, but, with the exception of the deeper anterior sinus, is very similar in character.

Test ornamented by about sixty strong, rounded rays, with some smaller intermediate elevated lines, which are crossed by regular, prominent, sub-imbricating lamellæ of growth, about 1.5 mm. apart. On crossing the rays, the varices of growth are bent suddenly upwards and backwards, forming short semi-tubular spines. The strong rays are absent upon the ears, but the lines of growth are numerous, and sharper than over the body of the shell.

The specimens are mostly partial casts of the interior, preserving no traces of the muscular impression, pallial line, or hinge characters, but retaining strong evidences of the external ornamentation of the shell. See fig. 7, pl. 3. Numerous individuals have a height of 55 mm., with usually a slightly greater length. The length of the hinge-line in mature examples is about 45 mm.

This well-defined species is readily distinguished by the slight obliquity of the body of the shell to the hinge-line, and the marked characters of the surface. It differs from *A. princeps* and *A. pecteniformis* in having strong and regular concentric markings, while the rays in these species are much more acute, and the axis of the shell is usually quite oblique to the hinge-line. Specimens which preserve the exterior shell show very beautifully the short spinous processes of the concentric lamellæ; as shown, of the natural size, in fig. 10, pl. 3. Examples of the species are abundant, and have a considerable vertical and horizontal range within the group in New York.

Formation and localities. In the shales of the Hamilton group, at Pratt's falls, and Delphi, Onondaga county; Ludlowville, Cayuga county; Bellona, Yates county; Geneseo, Livingston county, and other places in western New York.

AVICULOPECTEN EXACUTUS.

PLATE III, FIGS. 18–22.

Aviculopecten exacutus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 3, figs. 18–22. Jan., 1883.

SHELL of medium size, obliquely broad-ovate; greatest longitudinal diameter below the middle; height nearly equal to the length, transverse axis oblique to the hinge-line; basal margin full and regularly rounded; posterior margin extended beyond the ear, and more convex than the anterior.

Valves equally convex; the byssal sinus larger in the right valve, and the umbo less ample.

Hinge-line straight, length four-fifths the longitudinal diameter, extending nearly as far as the anterior margin.

Beak obtuse, oblique, anterior to the middle of the hinge and of the valve; umbo ample. In some specimens of the left valve, the beak arches over the hinge-line, while in the right valve the beak rises from the hinge.

Ears triangular; posterior one somewhat the larger, margin concave, extremity acute; defined from the umbo by a broad, shallow sulcus, an obscure carination, and an abrupt change in the surface characters to subdued striæ. The anterior ear is well-defined by the sulcus extending from the angular byssal sinus.

Test ornamented by about forty strong, sharp, continuous rays, alternating in size with broader and concave interspaces, crossed by fine, sharp, crenulating concentric striæ. The ears show finer concentric striæ and a few rays.

Pallial line impressed, continuous, extending parallel to the margin of the shell about half way from the beak, terminating near the centre of the posterior side, in a sub-circular, muscular impression, marked with regular concentric striæ. The cast preserves traces of the exterior markings, but presents no definite characters of the hinge.

The largest specimen has a height of 35 mm. A medium-sized specimen has a height of 26 mm.; length 27 mm.; hinge-line 24 mm.

This species differs from the young of *A. princeps*, in its more acute beak, smaller anterior ears, and in having rays on both ears; the rays on the body of the shell are also stronger. It resembles *A. formio* in outline, but has more sharply elevated rays, and less strong concentric striæ. *A. pecteniformis* has obtuse rounded beaks, and ears not marked by rays, which are distinguishing features of that species.

Formation and localities. In the shales of the Hamilton group, Monteith's Point, Ontario county; and Hamburg, Erie county, N. Y.

AVICULOPECTEN FORMIO.

PLATE V, FIGS. 20, 21.

Aviculopecten formio, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 5, figs. 20, 21. Jan., 1883.

SHELL of medium size, obliquely ovate, extended behind; length equal to or somewhat less than the height.

Valves depressed, slightly convex. The right and left valves are very similar; the right being somewhat less convex, and having finer surface markings.

Hinge-line straight, extending as far as the anterior margin; length two-thirds the height of the shell; ligamental area narrow.

Beaks well-defined, not rising above the hinge-line, situated anterior to the middle.

Posterior ear large, triangular, margin concave; the ornamentation differing from that on the umbo; defined by a slight depression and a change of convexity. Anterior ear small, defined by a well-marked sulcus; byssal sinus deep; margin convex near the extremity of the hinge-line. The area of the posterior ear is more than twice that of the anterior.

Test ornamented by about 35 rounded, radiating costæ, with intermediate smaller ones, crossed and crenulated by regular striæ of growth, of which there are about 10 in the space of 5 mm. On the ears the radiating lines are present, especially on the anterior ear, and the concentric striæ are more crowded than on the body of the shell.

The characters of the interior are not preserved.

The largest specimen has a length of 32 mm., and the hinge-line measures 23 mm. A smaller specimen, preserving both valves, has a length of 29 mm., and height about equal.

This species is distinguished from *A. exacutus* by the greater angle subtended by the sides of the umbo, by its greater obliquity, and the less sharp radiating costæ of the surface. In *A. Phorcus* the length is comparatively greater and hinge-line shorter, the ears smaller, and the strong crenulating striæ of growth do not occur.

Formation and localities. In the shales of the Hamilton group, at Fultonham, Schoharie county; and Hamilton, Madison county, N. Y.

AVICULOPECTEN PHORCUS.

PLATE V, FIG. 22.

Aviculopecten Phorcus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 5, fig. 22. Jan., 1883.

SHELL of medium size, obliquely ovate; height and length equal; anterior and basal margins regularly rounded, becoming more convex towards the middle of the posterior side, and thence concave to the beaks, giving the shell an appearance of considerable amplitude behind.

Left valve regularly and moderately convex. The right valve is unknown.

Hinge-line straight, about one-half the length of the shell.

Beak rounded, extending to and situated near the centre of the hinge-line; umbonal angle smaller than usual, being about 90°.

Ears comparatively small, triangular, with concave margins; posterior ear the larger, separated from the body of the shell by a difference in convexity and the absence of radiating lines; anterior ear defined by a sulcus.

Test marked by about 60 fine, rounded, radiating costæ, with a few intermediate smaller ones, and fine striæ of growth. The rays are absent on the ears, but the lines of growth are more distinct than on the body of the shell.

The characters of the interior have not been observed.

The specimen described has a height of 37 mm., and a greatest length of 26 mm.

This species differs from *A. formio* by its smaller ears, their distinct character, and the general surface-markings. It resembles young individuals of *A. princeps;* but the comparative size and extent of the ears are very different, while the body of the shell is more constricted at the base of the ears. *A. fasciculatus* is very similar in the general form of the body of the shell; but the length is greater than the height. The alæ and the ornamentation of the test are distinguishing characters.

Formation and locality. Hamilton group, Schoharie, N. Y.

AVICULOPECTEN FASCICULATUS.

PLATE V, FIGS. 9-17; AND PLATE LXXXI, FIGS. 1-4.

Aviculopecten fasciculatus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 5, figs. 9, 10, 12, 16, 17. Jan., 1883.
Aviculopecten repletus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 5, figs. 13-15. Jan., 1883.
“ *Orestes,* “ “ “ “ “ Pl. 5, fig. 11. “ “

Shell obliquely and transversely ovate; height more than seven-eighths of the length, produced behind. Pallial margins regularly rounded, becoming more convex towards the middle of the postero-lateral side, and extending in a straight or slightly concave line to the beaks.

Valves moderately convex, the right one more depressed when seen in connection with the other, shorter and comparatively less oblique.

Hinge-line straight, length nearly two-thirds the height of the shell; extending, in young individuals, as far as the anterior margins.

Beaks prominent, well-defined, situated anterior to the middle of the hinge-line. Umbo very convex.

Ears of the left valve triangular, the posterior one larger, more attenuate at the extremity, and defined by a sulcus; the margins concave from the rapidly sloping side of the prominent umbo. Ears of the right valve much narrower, and attenuate at the extremities, with fewer radiating lines, marked by a very deep byssal sinus.

Test ornamented with numerous filiform, radiating striæ, which are often fasciculate, and fine concentric lines of growth. The broad fascicles of striæ often extend across one interval of growth, and on the succeeding interval appear as regular or irregular striæ without aggregation, or as fascicles of finer striæ. This change does not always occur, but is very characteristic when seen, as in figure 17, plate 5, where the variation is so extreme that it affects the outline of the shell. In young specimens the rays are regular, with a slight fasciculate arrangement. The concentric lines are sharper and more crowded on the ears and the rays are more subdued.

Interior not observed.

One specimen has a height of 30 mm., and a length of 32 mm.; another specimen has a height of 23 mm., and a length of 25 mm.; the hinge-line is 16 mm.

The form and surface markings distinguish this species. It differs from *A. formio*, *A. princeps* and *A. pecteniformis* in its surface markings; and from *A. princeps* especially, by the presence of radii on the wings.

Several varieties were designated in the preliminary examination as *A. repletus* and *A. Orestes*; but a larger collection of specimens since these species were indicated has demonstrated the identity of the several forms, notably figs. 14 and 15 of plate 5, which do not show a fasciculation of the striæ.

Formation and localities. In the shales of the Hamilton group, Schoharie, Onondaga and Madison counties; also occurring in boulders of the coarse shales of the Hamilton group at Chemung Narrows, N. Y.

AVICULOPECTEN IDAS.

PLATE III, FIGS. 1, 2; PLATE XXIV, FIG. 4.

Aviculopecten Idas, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 3, figs. 1, 2; 24, fig. 4. Jan., 1883.

SHELL ovate-orbicular, transverse axis slightly oblique to the hinge-line; height nearly equal to or greater than the length; outline full in front, not extended posteriorly.

Right valve depressed; moderately convex. Left valve not observed.

Hinge-line straight, length less than two-thirds the length of the shell, extending farther towards the anterior than the posterior margin.

Beaks obtuse, well-defined, the umbo separated on each side from the ears by a distinct sulcus, which is more marked on the anterior side. The beaks are nearly in the centre of the hinge-line, but somewhat anterior to the middle of the shell.

Ears unequal. Anterior one about twice the size of the posterior, convex, margins convex; separated from the body of the shell by a deep sinus which is continued to the beak as a distinct sulcus. Posterior ear triangular, with margins concave.

Test thin, marked by fine, concentric lines of growth, and about 80 rounded, radiating striæ, which increase by interstitial addition, with the interspaces less than the striæ, of which there are from 7 to 9 in the space of 5 mm. at the pallial margin. The surface characters continue on the ears; but upon the posterior ear the radiating lines are very subdued, while on the anterior one they are quite prominent.

Interior characters not observed.

The largest specimen has a height and length nearly equal, and hinge-line

20 mm. Another individual has a height and length of 27 mm., and hinge-line 16 mm.

This species differs from *A. fasciculatus* in its comparatively larger anterior and smaller posterior ears, while the shell is less full behind, and the fasciculate surface has not been observed. In *A. formio* the posterior ears are much larger, and the surface is distinctly reticulate. In *A. scabridus* the beaks are more rounded, the wings more extended, and the surface quite different. Some forms of *A. duplicatus* and *A. rugæstriatus* resemble this species; but the posterior ears of those species are larger, the anterior pair wider, and the surface markings characteristic.

The specimen, figure 13, plate 7, from the Chemung group is very nearly related to this species. A careful examination reveals the following differences. *A. Itys* is less oblique in outline, radiating striæ less distinctly rounded, inclining to angular, distance between them greater than the striæ themselves; the evidence of the implantation of intermediate striæ is obscure; the concentric lines are more distant and sharper, leaving the radii in the cast distinctly crenulate.

Formation and localities. In the Hamilton group at Fultonham, Schoharie county; shore of Cayuga lake; and Darien, Genesee county, N. Y.

AVICULOPECTEN LAUTUS.

PLATE III, FIGS. 16, 17.

Aviculopecten lautus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 3, figs. 16, 17. Jan., 1883.

SHELL obliquely ovate, height equal to the length, valves depressed, convexity of right and left valves sub-equal.

Hinge-line straight, length about one-fifth less than the height of the shell, or in some specimens longer, extending as far as the anterior margin of the valve. Beaks depressed, obtuse, anterior to the centre of the hinge-line.

Ears sub-equal, triangular, flat, mucronate at the extremities, margins concave except in the anterior ear of the right valve, which is convex; defined by the umbonal carinæ, and by the absence of rays on the posterior slope. Byssal notch in the right valve angular, deep, continuing to the beak as a sulcus which separates the ear from the umbo.

The right valve, though very similar to the left, is not so high, and the anterior ear differs in form from the corresponding one in the left valve.

Test thin, ornamented by about 90 sharp rays, with concave interspaces having an equal number of intermediate finer rays, and crossed by numerous regular, sharp concentric striæ. The markings on the ears are similar to those on the body, but less strong.

Ligamental area very narrow, and marked on the outer margin by an inflection of the test. The other characters of the interior are not preserved.

The left valve of one specimen has a height of 23 mm., length 24 mm., hinge-line 23 mm.; the right valve of the same has a height of 22 mm., and a length of 24 mm. A larger specimen is 29 mm. in height, with an equal length.

This species resembles *A. exacutus* in outline, but differs in the lesser convexity and obliquity of the valves; the beaks are not prominent, and the surface characters are finer and more delicate. Young individuals of *A. scabridus* may be distinguished from this species by the more rounded and obtuse beaks, and rugose rays, which are usually absent on the ears. *A. formio* differs by its obliquity and the inequality of the ears, and the much stronger striæ.

Formation and localities. In the shales of the Hamilton group, at West Bloomfield, Ontario county, and York, Livingston county, N. Y.

AVICULOPECTEN RUGÆSTRIATUS.

PLATE VII, FIGS. 8-11; AND PLATE LXXXI, FIGS. 11, 12.

Lima rugæstriata, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 264. 1843.
Aviculopecten rugæstriatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, figs. 8-11. Jan., 1883.

SHELL longitudinally ovate, oblique, more convex in front; height one-fourth greater than the length; outline oblique-ovate, with the posterior margin depressed convex; the anterior margin more convex, and the base abruptly rounded.

Valves convex, very similar, except that the right valve shows an acute byssal sinus.

Hinge-line short, straight, length more than one-half the length of the shell.

Beaks acute, prominent, anterior to the middle of the hinge.

Ears small, broad-triangular; posterior one a little the larger, margin slightly concave; anterior ear defined by a distinct sulcus, which is narrow and deep in the right valve, margin convex; byssal sinus deep and acute. The posterior ear is less distinctly limited in the right valve.

Test near the beaks ornamented by fine filiform rays, which are crossed and crenulated by sharp, concentric striæ. Below the middle of the shell the rays become large rounded plications, increasing by implantation or bifurcation, and the regular concentric striæ are stronger, distinctly crenulating the rays, becoming foliate, and giving the surface a rugose appearance. The rays and concentric lines are present on the ears.

The interior is not preserved.

Two left valves have a height of 35 mm., and 22 mm.; length 29 mm. and 18 mm.; the hinge-line 16 mm. and 10 mm. respectively. A right valve of nearly the same proportions has a height of 33 mm., length 25 mm., and hinge-line 17 mm.

This species is distinguished from *A. duplicatus* by its comparatively greater height, the obliquity of the valve, and the acute beaks; the surface characters of the two are very similar. *A. cancellatus* is more circular in outline, and the anterior ears are larger than the posterior pair.

Formation and localities. Shales of the middle Chemung group, Philipsburg, Rockville and Hobbieville, Alleghany county, N. Y.

AVICULOPECTEN DUPLICATUS.

PLATE VII, FIGS. 1–7; AND PLATE LXXXI, FIGS. 9, 10.

Pecten duplicatus, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 264. 1843.
Aviculopecten duplicatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, figs. 1–7. Jan., 1883.

SHELL ovate-orbicular, sub-equilateral, height usually less than the length; greatest length below the centre of the shell, giving a somewhat truncated appearance to the base.

Valves moderately convex; very similar in dimensions and convexity; the central position of the beaks makes the valves nearly equilateral. The right valve is marked by a deep byssal sinus.

Hinge-line straight, central, length from more than one-half to two-thirds the length of the shell. Ligamental area narrow.

Beaks rounded, obtuse, sub-central. Umbo prominent, ample.

Ears small. Anterior larger and well-defined by the sulcus extending from the sinus to the beak. Posterior one small, triangular; margins concave. Byssal notch deep and abrupt.

Test ornamented with regular duplicating rays, which increase in strength towards the margins, crossed by fine, regular, foliate, concentric expansions of the test. In well-preserved specimens this character of surface gives a decided limate appearance, and somewhat resembles *A. rugæstriatus.* In weathered specimens this surface character is subdued to a reticulation and crenulation. Near the beaks the shell is nearly smooth; towards the margins it is sometimes marked by strong, rounded plications. The rays and concentric lines are continued over the ears, and the anterior ear usually has several stronger plications.

A right valve, somewhat larger than usual, has a height of 31 mm., length 35 mm., and hinge-line 20 mm. A medium example has a height of 27 mm., length 30 mm., and hinge-line 18 mm. Younger forms vary slightly from these proportions; a small left valve measures 23 mm. in height and length, with a hinge-line of 15 mm.

This species resembles *A. rugæstriatus* in surface characters, but it is less oblique and proportionally much longer, with beaks more obtuse. The outline of *A. cancellatus* is more nearly circular, and the direction of the transverse axis is oblique. From *A. scabridus* it differs in its shorter hinge-line and smaller ears, as well as in the surface markings.

Formation and localities. In the calcareous shales of the middle Chemung group, Rockville, Hobbieville and Philipsburg, Alleghany county; East Randolph, Cattaraugus county, N. Y.; and Mansfield and Sullivan, Tioga county, Pennsylvania.

AVICULOPECTEN CANCELLATUS.

PLATE VII, FIGS. 12, 14–19.

Pecten cancellatus, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist. 1843.
Not *Aviculopecten cancellatulus*, McCOY.
Pecten Halleanus,* D'ORBIGNY. Prodrome de Palæontologie, vol. I, p. 87, No. 768. 1847.
Aviculopecten sub-cancellatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, figs. 12, 14–19. Jan., 1883.

SHELL small, broadly ovate, oblique, height a little greater than the length; anterior lateral margin full and rounded; posterior lateral margin, below the ears, gently curving.

Right valve regularly convex, sloping somewhat abruptly to the posterior ear.

Hinge-line straight, equal to two-thirds the length of the shell.

Beaks, anterior to the middle of the hinge-line, well-defined, obtuse.

Posterior ear small, undefined, the lateral margin concave, not projecting. Anterior ear marked by a deep sinus, with a sulcus extending to the beak; lateral margin rounded.

Test marked by fine, regular, rounded, radiating lines, crossed by regular sharp, concentric striæ, producing an evenly cancellate surface. The posterior ear is marked by the concentric striæ with obscure radiating lines; the anterior ear is rugose from the prominence of from four to six strong rays.

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* This name was proposed by d'Orbigny as a substitute for *Pecten cancellatus*, a name preoccupied by Phillips for an Oolitic fossil. The latter is probably a true Pecten, and there seems to me no sufficient reason why the original name may not be retained. *Avicula cancellata*, Phillips, Palæozoic Fossils, is probably not an Aviculopecten.

Interior characters not known.

The original of this species is 20 mm. in height, 19 mm. in longitudinal diameter, and the length of hinge-line 12 mm. Another specimen is 14 mm. in height and 12 mm. in length.

This species is distinguished from *A. duplicatus* and *A. rugæstriatus* by the less rugose surface, smaller size and different outline. The form of the ears and byssal sinus is very similar to *A. duplicatus*, but differs in the regular reticulate surface; that species is also a comparatively longer shell. It is in shape more like *A. rugæstriatus*.

Formation and localities. In the middle members of the Chemung group, at Philipsburgh and Rockville, Alleghany county; Conewango, Cattaraugus county; and near Westfield, Chautauqua county, N. Y.

AVICULOPECTEN ÆQUILATERALIS, n. sp.

PLATE LXXXII, FIG. 1.

SHELL of medium size, transversely ovate, erect, equilateral; height equal to the length; lateral and basal margins regularly rounded; upper anterior and posterior margins extending in nearly a straight line to the beak.

Left valve slightly convex; greatest convexity on the umbo.

Hinge-line straight, nearly two-thirds the length of the shell, situated centrally.

Beak well-defined, situated near the centre of the hinge-line.

Ears sub-equal, triangular, defined from the umbo by a sinus in the margin, with a sulcus extending to the beak; margins slightly convex; extremities rounded.

Test ornamented with about sixty regular, straight, alternating rays, crossed by fine, irregular striæ of growth. The rays are present on the ears, and are more numerous on the anterior ear.

The specimen described has a length and height of about 38 mm., and hinge-line of 22 mm.

This species is distinguished by its erect equilateral form, sub-equal ears, and the strong, regularly alternating radii.

Formation and locality. In the upper beds of the Chemung group at Alleghany Sulphur Springs, Warren county, Pa.

AVICULOPECTEN ITYS.

PLATE VII, FIG. 13.

Aviculopecten Itys, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, fig. 13. Jan., 1883.

SHELL small, broadly ovate, length nearly equal to the height, slightly oblique; margins regularly rounded, nearly equilateral.

Right valve depressed-convex. Left valve not known.

Hinge-line straight, sub-central, having an extent of a little more than one-half the greatest length of the shell.

Beak acute, directed slightly forward. Posterior umbonal slope making a greater angle with the hinge-line than the anterior. Umbo subtending a right angle.

Ears nearly equal. Anterior ear the larger, obtuse at the extremity, marked by several strong radii, separated from the umbonal region by a strong sulcus. Posterior ear narrow, triangular, margin concave, separated by a distinct sinus from the body of the shell, with no rays of ornamentation; obtuse-angular. Byssal sinus well-defined.

Surface marked by sub-angular, rounded radii, which are regularly increased in size with the growth of the shell, but rarely increased in number by implantation; concentrically marked by fine, regular, thread-like striæ of growth.

Interior characters unknown. Hinge margin apparently simple.

The specimen described has a length of 25 mm., height 27 mm., hinge-line 13 mm.

This species is less oblique than *A. Idas*, the hinge-line shorter, radii not present on the posterior ear, surface markings coarser; and rays increasing more rapidly in size though fewer in number. In *A. cancellatus* (=*A. Halleanus*, d'Orbigny), the valve is more convex, beak more obtuse, and the concentric marking forms a prominent feature.

Formation and locality. In the Chemung group at Conewango, Cattaraugus county, N. Y.

AVICULOPECTEN PLENUS.

PLATE XXIV, FIG. 3.

Aviculopecten plenus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, fig. 3. Jan., 1883.

SHELL sub-orbicular, sub-equilateral; transverse axis nearly vertical to the hinge-line; height one-sixth less than the length, giving a marked fullness to the outline of the sides.

Left valve convex, the convexity equal to one-sixth the length of the shell. The point of greatest convexity distant one-third the length from the beak. Right valve not observed.

Hinge-line straight, nearly central, the length more than two-thirds the length of the shell.

Beak obtuse, situated centrally with regard to the hinge-line, and also to the body of the shell; umbo rounded.

Ears sub-equal, triangular. Posterior ear mucronate at the extremity; margin deeply concave. Anterior ear acute at the extremity, and the margins convex; separated from the umbo by an abruptly sloping sulcus extending to the beak.

Surface ornamented with about 130 regular, rounded, close, filiform radii, crossed by very fine, sharp, concentric striæ. The surface markings are present on the ears, the radii distinct and stronger than on the adjacent portions of the shell. The rays become more frequent and finer from the basal margin in both directions towards the ears.

Interior not preserved in the specimen described.

The height of the specimen is 25 mm., length 30 mm., hinge-line 21 mm. On the lower margin there are 9 rays in the space of 5 mm.

In form, this species bears considerable resemblance to *A. duplicatus;* but the surface markings are quite different, and the extremities of the hinge line are more acute in this species. In *A. scabridus* the beak is not so well defined, the ears usually more extended, and the coarser rugose radii of that species are characteristic. This form resembles some varieties of *A. fasciculatus* in the surface characters, but differs in the obliquity of the shell and form of the ears. It differs from *A. Idas* in the more rotund form, more numerous and elevated rays, and larger ears.

The single valve described appears to be well distinguished from all the other species, and possesses characters too remote to be united with any of those described from right valves alone.

Formation and locality. In arenaceous shales of the middle Chemung group, near Elmira, N. Y.

AVICULOPECTEN STRIATUS.

PLATE X, FIGS. 3, 4.

Pecten striatus, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist. 1843.
Aviculopecten striatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 10, figs. 3, 4. Jan., 1883.

SHELL transversely ovate, scarcely oblique, nearly equilateral, width somewhat greater than the length.

Hinge-line straight, two-thirds the length of the shell, situated centrally in regard to the body of the shell, not extending as far as the margin.

Beak central to the hinge-line, well-defined, arching over the hinge; umbo prominent, the sides subtending a right angle.

Ears sub-equal, triangular, defined by the rapid slope of the sides of the umbo. Anterior ear the larger, limited by a broad sinus; margins slightly convex; extremity rounded. Posterior ear acute at the extremity; margins concave.

Test ornamented with fine, rounded, closely arranged, regular radiating striæ, from 12 to 14 in the space of 5 mm. at the pallial margin. Some specimens show a slight flattening of the rays and also fine lines of growth. The ears present the same surface characters.

Ligamental area narrow, well-marked, its width is .5 mm. in a specimen of 20 mm. in height.

The original specimen of this species is 20 mm. in height, 18 mm. in length, and the hinge-line 13 mm. Another specimen is 13 mm. in height, 11 mm. in length, hinge-line 8 mm. The largest specimen found has a height of 22 mm.

This species resembles *A. celsus* more nearly than any other form here described; it differs from that one by its much smaller ears with concave margins, more obtuse umbo, regular, equal striæ, and comparatively shorter form. The two species agree in the non-obliquity of the body of the shell to the hinge-line. This species has a vertical range from the middle to the upper members of the Chemung group, but is not abundant.

Formation and localities. In the Chemung group at Painted Post, Steuben county; Chemung Narrows, Tioga county, N. Y.; and in Bradford, Tioga and Warren counties, Pennsylvania.

AVICULOPECTEN CELSUS.

PLATE VII, FIGS. 29, 30.

Aviculopecten altus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, figs. 29, 30. Jan., 1883.

Not *Aviculopecten altus*, WHITE. Bull. U. S. Geol. Surv., vol. v, p. 110. 1879.

SHELL small, ovate cuneiform, sub-equilateral, not oblique; height one-fifth greater than the length; pallial margin rounded to near the ears, where the sides of the shell are nearly straight.

Right valve convex; the greatest convexity being equal to one-fourth the length of the hinge-line. Left valve not observed.

Hinge-line straight, length three-fourths the length of the shell, not extending as far as either lateral margin.

Beak acute, straight, extremity pointed, arching over the hinge-line; umbo prominent, subtending an angle of 80°.

Ears broad-triangular, large, flat, sub-equal, the margins slightly convex; extremities rectangular; separated from the body of the shell by a moderate sinus, and from the sides of the umbo by a sulcus ; the byssal sinus is deep and rounded.

Test marked by fine alternating filiform radiating striæ, which are absent on the ears, except as two or three alternating undulations. Fine lines of growth mark the test and extend over the ears.

Ligamental area linear and marked by an inflection of the hinge-margin.

The specimen has a height of 15 mm. and a length of 13 mm., hinge-line 10 mm. About 13 rays occupy the space of 5 mm., measured near the basal margin.

This form may be distinguished by its equilateral proportions, acute, straight apex, the non-obliquity of the transverse axis to the hinge-line, the broad, triangular ears and the alternating surface striæ. These characters separate it from *A. striatus,* to which it is most nearly allied.

Formation and locality. In sandstone of the conglomerate, associated with the upper Chemung group, at Salamanca, Cattaraugus county, N. Y.

AVICULOPECTEN PATULUS.

PLATE VII, FIGS. 32, 33.

Aviculopecten patulus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 32, 33. Jan., 1883.

SHELL large, longitudinally broadly elliptical; height about five-sixths as great as the length. The axis of greatest height is at right angles to the hinge, and the line of greatest length is parallel to the hinge and across the middle of the shell. Basal margin convex, somewhat flattened in the middle. Lateral margins very full, and curving rapidly to the ears.

Valves convex, the convexity equal to one-fourth the length of the hinge-line. The right and left valves do not differ conspicuously in character, so far as observed.

Hinge-line apparently straight, equalling nearly two-thirds the length of the shell, central, not extending as far as either lateral margin.

Beaks obtuse, rounded; umbo prominent, straight, central, well-defined by its gibbous form and the rapid slope of the sides. Umbonal angle 110°.

Ears broad-triangular, sub-equal, separated from the body of the shell by a broad, deep sinus; margins concave below, becoming convex above the middle; extremities rounded.

Test ornamented by regular, sharp radii, with broader concave interspaces, and some finer radii, crossed by irregular crenulating lines of growth. Near the basal margin of a large specimen, there are five of these rays in the space of 10 mm. A smaller specimen has eleven rays in the same space.

The interior is not preserved.

The measurements of one individual are: height 55 mm., length 69 mm., hinge-line 41 mm.; of another specimen, height 26 mm., and length 30 mm.

This species nearly resembles in form *A. ellipticus*, and differs by its sharp, crenulated radii, while that species is marked by strong, rounded, continuous plications; and the hinge-line is comparatively somewhat longer. These two forms differ from others in their broad longitudinally elliptical outlines, and the amplitude of the umbones.

Formation and locality. In conglomerate and sandstone, associated with the Upper Chemung group, at Rock City, near Salamanca, Cattaraugus county, N. Y.

AVICULOPECTEN ELLIPTICUS.

PLATE VII, FIG. 31.

Aviculopecten ellipticus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, fig. 31. Jan., 1883.

SHELL large, longitudinally broadly elliptical, equilaterial, not oblique; height equal to about four-fifths of the length; margins regularly convex and rapidly curving to the beak.

Left valve capacious, convex. Right valve not observed.

Hinge-line straight, central, length equal to about one-half the length of the shell.

Beak straight, central, obtuse, rounded; umbonal angle about 110°.

Ears sub-equal, broad-triangular, flat; margins slightly convex; extremities rectangular, defined by a gentle sinus, which is deeper below the anterior ear.

Test marked by about 35 strong, rounded, radiating continuous plications which are wider than the interspaces. These radii are absent on the ears. The striæ of growth are irregular and mark the entire surface of the shell.

Internal characters not observed.

A large specimen has a height of 53 mm., length 66 mm., hinge-line 34 mm.

This species differs from *A. patulus* in its shorter hinge-line, and the strong rounded radiating plications.

Formation and locality. In sandstone of the upper part of the Chemung group at Meadville, Crawford county, Pennsylvania.

AVICULOPECTEN DOLABRIFORMIS.

PLATE VII, FIG. 21.

Pecten? dolabriformis, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 265. 1843.
Aviculopecten dolabriformis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, fig. 21. Jan., 1883.

SHELL small, sub-orbicular, slightly oblique; height nearly equal to the length; margins regularly rounded, becoming more inflated and convex posteriorly.

Right valve moderately convex. Left valve unknown.

Hinge-line straight, central, more than two-thirds the length of the shell.

Beak central, straight, obtuse, rounded, not rising above the hinge-line; umbo well defined by the rapid slope of the sides and the flatness of the ears.

Ears triangular, flat; margins slightly concave; extremities obtuse-angular. Posterior ear of the right valve about one-third larger than the anterior. Byssal sinus not marked.

Test cancellate, marked by fine radii and concentric striæ, which characters are also preserved on the ears.

Internal characters not known.

A right valve has a height of 11 mm., length 12 mm., and hinge-line 8 mm.

This small species somewhat resembles *A. squama* in the form of the body and surface markings, but the beak is less acute and the anterior ear comparatively smaller, without distinct sinus.

Formation and locality. In the arenaceous shales of the Chemung group at Philipsburg, Alleghany county, N. Y.

AVICULOPECTEN SQUAMA.

PLATE VII, FIG. 20.

Aviculopecten squama, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, fig. 20. Jan., 1883.

SHELL transversely broad-elliptical, slightly oblique; height about nine-tenths of the length.

Right valve moderately convex. Left valve not known.

Hinge-line straight, length two-thirds the length of the shell, extending in front as far as the anterior margin of the valve.

Beak rounded, not rising above the hinge-line, situated posterior to the centre; umbonal angle 90°.

Posterior ear small, triangular, narrow, with concave margin; not strongly defined; extremity angular. Anterior ear large, convex, broad-triangular; extremity obtuse; margin convex; separated from the body by a deep rounded sinus, and from the sides of the umbo by a distinct sulcus.

Test marked by very fine radiating striæ and irregular lines of growth. These surface characters extend also over the ears.

Internal characters not known.

The specimen described is 11 mm. in height, 12.5 mm. in length, and hinge-line 8 mm.

This species differs from *A. dolabriformis* in its more acute beak, absence of regular concentric striæ, and much larger anterior ear.

Formation and locality. In the Chemung group at Philipsburg, Alleghany county, N. Y.

AVICULOPECTEN CONVEXUS.

PLATE VII, FIGS. 22, 23.

Pecten ? convexus, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 265. 1843.
Aviculopecten convexus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, figs. 22, 23. Jan., 1883.

SHELL small, sub-orbicular, not oblique; height somewhat greater than the length; margins regularly rounded.

Left valve very convex, convexity equal to about one-third the length of the shell. Right valve not known.

Hinge-line straight, central, length three-fifths the length of the shell.

Beak prominent, straight, central, rounded, arching over the hinge-line; the sides of the umbo subtend a right angle.

Ears broad-triangular, extremities obtuse-angular. Posterior ear of left valve smaller than the anterior, defined by the abrupt slope of the umbo; margin slightly concave. Anterior ear convex; margin straight; separated from the umbo by a very deep and narrow sulcus. Byssal sinus small.

Test marked by fine irregular radiating striæ and finer regular concentric lines; the same surface characters are continued over the ears. The specimen is exfoliated and the radii represented in the figure are partially restored.

Interior characters unknown.

The original of this species has a height of 12.5 mm., length 12 mm., and hinge-line 8 mm.

The remarkable convexity of the left valve distinguishes this species from all the other forms here described. Its orbicular outline, prominent beak and deep anterior sulcus are also characteristic. In general appearance the body of the shell resembles some forms of Athyris and Meristina among the Brachiopods, but its pectinoid character is well marked.

Formation and locality. In the shales of the Chemung group at Rockville, Alleghany county, N. Y.

AVICULOPECTEN SIGNATUS.

PLATE VII, FIG. 24.

Avicula? signata, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 265. 1843.
Aviculopecten signatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, fig. 24. Jan., 1883.

SHELL small, obliquely sub-elliptical, the longest diameter making an angle of about 45° with the hinge-line; height and length nearly equal.

Left valve depressed, slightly convex. Right valve unknown.

Hinge-line straight, length more than two-thirds the length of the shell, extending in front as far as the anterior margin.

Beak very obtuse, rounded, depressed, directed forward, situated near the centre of the hinge.

Ears triangular, sub-equal, flat. Anterior ear separated from the umbo by a sulcus; margin convex; extremity rounded. Byssal sinus moderately deep. Posterior ear not well-defined; margin slightly concave; extremity obtuse-angular.

Test conspicuously marked by fine, regular, lamellose concentric lines, and a few irregular, radiating, indented striæ.

Interior characters not observed.

The original of this species is 11 mm. in length and height; the hinge-line 8 mm.

This species is distinguished by the oblique, elliptical outline of the body of the shell, the depressed, obtuse beak, and the well-defined concentric striæ.

Formation and locality. In the Chemung group at Rockville, Alleghany county, N. Y.

AVICULOPECTEN CAROLI.

PLATE IX, FIG. 5.

Aviculopecten Caroli, WINCHELL. Proceedings Acad. Nat. Sci., Phila. 1863.
Aviculopecten Caroli, (WINCHELL) HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, fig. 5. Jan., 1883.

SHELL small, sub-circular, not oblique, length and height equal; basal margin regularly rounded.

Left valve convex, the convexity equal to about one-sixth of the longitudinal diameter. Right valve unknown.

Hinge-line straight, length three-fourths of the diameter, extending nearly to the anterior margin of the shell.

Beak obtuse, prominent, central, rising above the hinge.

Ears triangular, nearly equal, separated from the umbo by distinct sulci. Anterior ear with slightly convex margin; extremity rounded. Byssal sinus deep. Margin of posterior ear concave; extremity abruptly mucronate.

The test (as preserved on a partial cast of the interior) is marked by about 45 regular alternating, rounded rays with equal interspaces. The lines of growth are fine and obscure on the specimen. The ears are marked by from five to eight rays similar to those on the body of the shell.

The ligamental area is a linear furrow along the hinge-line; cartilage pit small, situated under the beak.

The left valve described has a height of 17 mm., and an equal length; hinge-line 13 mm.

In the original description of this species mention is made of small, spinose processes from the concentric striæ; these do not exist in this specimen, which is a partial cast of the interior.

This species is distinguished from *A. striatus* by its more circular form, obtuse beak, and stronger radii. Compared with *A. elongatus*, the wings are smaller, and the height comparatively much less.

Formation and locality. In the yellow sandstone of the Waverly group at Newark, Ohio.

AVICULOPECTEN (CRENIPECTEN?) INCULTUS.

PLATE IX, FIG. 3.

Aviculopecten (Crenipecten?) incultus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl 9, fig. 3. Jan., 1883.

SHELL small, longitudinally very broad-elliptical, nearly circular, not oblique to the hinge-line, sub-equilateral; height somewhat less than the longitudinal diameter; basal margin regularly rounded.

Right valve depressed, convex. Left valve unknown.

Hinge-line straight, central, length one-half the length of the shell.

Beak obtuse, rounded, not rising above the hinge-line; sides of the umbo straight.

Ears small, sub-equal, narrow-triangular, separated from the sides of the umbo by sulci. Margin of posterior ear concave; extremity obtusely angular. Anterior ear defined by a deep, angular byssal sinus; margin convex; extremity rounded.

The external markings of the test are not preserved. The cast of the interior is nearly smooth. Pallial line faintly impressed. At each side of the umbo there is a shallow, undefined impression, nearly parallel to the margin, extending to about the middle of the length of the shell.

A specimen of the right valve has a height of 15 mm., length 17 mm., hinge-line 8 mm.

This species approaches very nearly several forms referred to Crenipecten. More perfect material may show the hinge to be crenulate, which character would exclude it from Aviculopecten.

Formation and locality. In conglomerate, referred to the Upper Chemung group, near Olean, Cattaraugus county, N. Y.

Aviculopecten (Pterinopecten ?) invalidus.

PLATE I, FIG. 18; AND PLATE LXXXII, FIG. 21.

Pterinopecten invalidus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 18. Jan., 1883.

Shell small, rhomboidal; length and height nearly equal, moderately oblique; margins regularly rounded, full behind; the greatest posterior extension is below the middle.

Left valve depressed-convex. Right valve unknown.

Hinge-line nearly straight, length a little more than the length of the valve, and extending anteriorly.

Beak obtuse, rounded, situated just anterior to the centre of the hinge-line, directed slightly forward, depressed. Umbonal region moderately prominent, subtending an angle a little less than 90°.

Ears triangular, flat, extremities acute. Anterior ear smaller, defined by a sulcus; margin nearly straight. Posterior ear with the margin concave, extremity acuminate; having no strong radiating striæ.

Test, as indicated in an exfoliated specimen, marked by a few fine radiating striæ, with wider interspaces which are marked by finer radii. Anterior ear showing the same characters. Posterior ear free from rays. Fine concentric striæ cross the rays, and stronger concentric wrinkles interrupt them and produce a slight crenulation of the radii.

The specimen is 10.5 mm. in length, 10 mm. in height, with hinge-line a little more than 11 mm.

This species resembles in form the young of *Pterinopecten dignatus*, but differs in the finer radiating lines on the body of the shell, the concave margin, and absence of rays on the posterior ear.

Formation and locality. In the black Marcellus shale at Cherry Valley, Otsego county, N. Y.

AVICULOPECTEN (PTERINOPECTEN ?) TERMINALIS.

PLATE I, FIG. 3.

Pterinopecten terminalis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 3. Jan., 1883.

SHELL small, rhomboidal; body of the shell obliquely ovate; length a little greater than the height; margins regularly rounded, somewhat extended behind.

Left valve very convex. Right valve unknown.

Hinge-line straight, central, equal to the length of the shell.

Beak acute, prominent, directed a little forward, arching over the hinge-line. Umbo elevated, subtending a right angle.

Ears triangular; margins concave; extremities acute. Posterior ear larger, undefined. Anterior ear limited by a shallow sulcus. Byssal sinus moderate.

Test thin, marked by fine sharp radii, with wider interspaces, which show one, two or three finer rays, crossed by fine crenulating lines of growth. The same characters of marking extend over the ears.

Internal characters not known.

The specimen is 14 mm. in length, 12 mm. in height, with hinge-line 15 mm.

This species, in surface markings, bears a slight resemblance to a young individual of *Aviculopecten princeps;* but the undefined ears and proportionally longer hinge-line distinguish it.

Formation and locality. In the upper layers of the Corniferous limestone; Young's farm, Williamsville, Erie county, N. Y.

SECTION *b*.

AVICULOPECTEN IGNOTUS.

PLATE I, FIG. 2.

Aviculopecten ignotus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 2. Jan., 1883.

SHELL of medium size, transversely and obliquely sub-ovate; height about five-sixths of the length; margins regularly rounded, full on the anterior and posterior sides.

Left valve slightly convex, nearly flat. Right valve unknown.

Hinge-line straight, central, length nearly equal to the height of the valve.

Beak obtuse, rounded, low, directed toward the anterior.

Posterior ear large, broad-triangular, separated from the side of the umbo by a wide shallow sulcus; margin slightly concave; extremity obtuse-angled. Anterior ear less than one-half the width of the posterior, narrow-triangular, separated from the umbo by a deep byssal sinus and a distinct sulcus, extending to the apex of the beak; margin convex; extremity rounded.

Test thin, about .5 mm. in thickness; marked with about twenty-five irregular, rounded radii, which are crossed by very fine concentric striæ, and occasionally interrupted by varices of growth. The rays are conspicuous over the centre of the valve, becoming obscure toward the margins. The ears show the concentric striæ only.

The characters of the interior are not known.

A specimen of the left valve measures 25 mm. in height, 29 mm. in length, and the hinge-line 21 mm.

This species in general expression resembles *A. tenuis*, but is distinct in its smaller anterior ear, more obtuse beak, orbicular form, and more irregular and stronger rays. Their geological positions are widely separated.

Formation and locality. In soft shaly beds of the Corniferous limestone, which constitute the upper portion of the group, at Lapham's mill, near Victor, Ontario county, N. Y.

AVICULOPECTEN INSIGNIS.

PLATE I, FIG. 8; PLATE III, FIG. 13; AND PLATE LXXXI, FIG. 7.

Aviculopecten insignis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 8; pl. 3, fig. 13. Jan., 1883.

SHELL less than medium size, sub-rhomboidal, moderately oblique, about one-third longer than high; basal margins rounded; anterior and posterior margins obtusely angular or abruptly rounded, and extending along the cardinal slopes in a direct line to the beak.

Both valves are quite convex; right valve somewhat the less convex.

Hinge-line straight, nearly equal to the length of the shell.

Beak obtuse-angular, prominent, directed forward, nearly central. Umbonal region ample, the sides subtending an obtuse angle, and sloping more abruptly to the anterior than to the posterior margin.

Ears sub-equal, triangular. Anterior ear concave or flat, defined by a distinct sulcus; margin deeply concave; extremity acuminate. Byssal sinus deep and well-marked. Posterior ear flattened, defined by the absence of the stronger radii; extremity slightly acute; margin concave.

Test thin, marked by strong radiating costæ, which in the left valve are abruptly elevated and increase by interstitial addition; crossed by infrequent elevated thread-like concentric crenulating striæ, which sometimes give a nodose character to the radii, and by finer lines of growth. The right valve is marked by rounded rays arranged in pairs, bifurcating on the umbo, crossed by fine concentric lines of growth. The radiating striæ are obscure on the ears, being more strongly marked on the anterior one.

The interior characters have not been observed.

The largest specimen has a length of 27 mm., height 20 mm., hinge-line 23 mm. A smaller specimen of 18 mm. in length has a hinge-line of precisely the same length.

The specimen figured on plate 1 is a young individual and does not well show the characters of the species which are better seen on the other figures referred to. See plate 81, fig. 7.

This species is less oblique, and the extremity of the posterior ear is less mucronate than in *A. bellus* and *A. ornatus.* The surface markings are very similar to the former, but quite distinct from the latter.

Formations and localities. In limestone above the Marcellus shales, at Stafford, Genesee county; in the softer shales of the Hamilton group at Moscow, Livingston county; and at Hamburgh, Erie county, N. Y.

AVICULOPECTEN BELLUS.

PLATE II, FIGS. 5, 6, 9; AND PLATE LXXXI, FIG. 8.

Avicula bella, CONRAD. Annual Geolog. Rep. N. Y., p. 54. 1841.
Aviculopecten bellus (CONRAD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 2, figs. 5, 6, 9. Jan., 1883.

SHELL small, longitudinally sub-elliptical; height equal to two-thirds or three-fourths of the length; margins regularly rounded.

Valves moderately convex; the right valve somewhat shallower than the left; very similar in form and ornamentation.

Hinge-line straight, the length a little greater than the longitudinal diameter of the shell, nearly central, extending equally beyond the posterior and anterior margins.

Beaks obtuse-angled, directed forward, placed anterior to the middle of the valve; sides of the umbo carinate, and descending abruptly to the ears.

Posterior ear flat or concave, narrow-triangular, well-defined by the carinate sides of the umbo, and by the absence of the strong surface radii; margin concave; extremity acute, mucronate. Anterior ear about two-thirds as long as the posterior one, triangular, convex; defined by a deep sulcus, and the angular cardinal slope of the umbo; margins of the ears in the left valve straight or concave; in the right valve, convex; extremities acute-angled. In the left valve the byssal sinus is broad and rounded; in the right valve it is a deep, angular notch.

Test of the left valve marked by from 40 to 50 regular, continuous, thread-like rays, alternating in fours, with three degrees of prominence, crossed and crenulated by fine, regular, concentric striæ. The surface of the right valve is nearly the reverse of this, having broad, flattened rays, arranged in pairs, regularly bifurcating, with narrow concave interspaces which correspond to the rays of the opposite valve. The posterior ears show several delicate rays extending from the apex of the beak over their upper portion.

The interior is not known.

A specimen preserving both valves has a height of 14 mm., length 19 mm., and hinge-line 20 mm. A right valve has a height of 14 mm., length 22 mm. A left valve has a height of 12 mm., length 16 mm., hinge-line 17 mm.

This species in appearance resembles *A. ornatus*, and differs in its longitudinally narrower outline, more obtuse beak, the numerous rays, and the absence of strong, lamellose, concentric fimbriæ. The two forms are of a group resembling several species in a parallel group of the genus Actinoptera, which are remarkable as possessing an aviculoid character (when compared with some recent species of *Avicula*); in the strong rays, the deep anterior sulcus and byssal sinus separating the anterior ears from the body of the shell.

Formation and localities. In the soft shales of the Hamilton group at Tinker's Falls, Onondaga county; Bellona, Yates county; and near Norton's Landing, Cayuga lake, N. Y.

AVICULOPECTEN ORNATUS.

PLATE II, FIGS 7, 8; AND PLATE III, FIG. 14.

Aviculopecten ornatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 2, figs. 7, 8; pl. 3, fig. 14. Jan., 1883.

SHELL small, longitudinally oblique-ovate, sub-rhomboidal; length and width in the proportion of three to four; margins regularly rounded.

Valves depressed-convex; left valve somewhat more convex than the right, and a little larger.

Hinge-line straight, slightly less than the length of the shell, central with regard to the body of the shell.

Beak obtuse-angular, directed forward, situated a little anterior to the middle.

Ears sub-equal. Posterior one the larger, triangular, flat or concave, defined by the abrupt post cardinal slope of the umbo; extremity acute; margin concave. Anterior ear defined by a deep sulcus; byssal sinus deep, more strongly marked in the right valve.

Test of the left valve ornamented by about 25 strong, sharp, elevated rays, and wide interspaces which are marked with a smaller ray; crossed by undulating, concentric striæ which are curved backwards between the stronger rays, producing arched fimbriæ. The right valve shows the radiating striæ originating near the umbo, which is smooth, and increasing by a double bifurcation, giving them a fasciculate appearance; they are crossed by undulating, concentric striæ. The ears are marked by strong, radiating lines and fine, concentric striæ.

Internal characters not observed.

The length of the largest specimen is 18 mm., height nearly 15 mm., and hinge-line about 17 mm.

This species, in form and general appearance, is very similar to *A. bellus;* it differs conspicuously in the ornamentation, with proportionally shorter posterior ear. Both species show the smooth area on the umbo of the right valve; a character not observed in any other species here described.

Formation and locality. In the Hamilton group; shores of Canandaigua lake, Ontario county, N. Y.

AVICULOPECTEN MUCRONATUS.

PLATE III, FIG. 15.

Aviculopecten mucronatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 3, fig. 15. Jan., 1883.

SHELL small, rotund-ovate, slightly oblique; length a little greater than the height. Basal and anterior margins regularly rounded; posterior margin full, abruptly sloping to the beak.

Left valve strongly convex. Right valve not observed.

Hinge-line straight, equal to the greatest length of the shell, extended anteriorly.

Beak obtuse-angular, directed forward, nearly central. Umbo deep, sides subtending an obtuse angle, sloping to the ears.

Ears sub-equal. Anterior ear narrow-triangular, elongate, acuminate, defined by the deep byssal sinus and marked sulcus; margin concave. Posterior ear wider, limited by an undefined sulcus; margin concave; extremity acute.

Test ornamented by rounded radii, which bifurcate towards the margin; crossed by prominent, regular, concentric striæ.

Hinge-area simple.

The specimen has a length of 16 mm., height 15 mm., hinge-line 16 mm.

This species differs from *A. insignis*, *A. bellus* and *A. ornatus* in the following characters: the anterior ear is narrower, the outline of the shell is less oblique, and the form is more rotund.

Formation and locality. In calcareous shales of the Hamilton group at Dresden, Yates county, N. Y.

AVICULOPECTEN TENUIS.

PLATE VII, FIGS. 27, 28; AND PLATE LXXXI, FIG. 6.

Aviculopecten tenuis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 7, figs. 27, 28. Jan., 1883.

SHELL small to medium size, sub-orbicular, transverse axis oblique; length and height equal; margins regularly rounded, somewhat extended behind.

Left valve slightly convex, nearly flat. Right valve unknown.

Hinge-line straight, nearly central,; length five-sixths of the longitudinal diameter.

Beak directed forward, not rising above nor extending beyond the hinge, anterior to the centre of the hinge-line and of the valve. Umbonal angle 90°.

Ears large, broad-triangular, unequal, separated from the sides of the umbo by a broad, shallow sulcus. Anterior ear about one-half the size of the posterior, flat; margin convex; extremity obtuse-angular. Byssal sinus broad and comparatively shallow. Posterior ear marked by a low, convex undulation, adjacent and parallel to the sulcus; margin straight or slightly concave; extremity rectangular, pointed, more obtuse in mature specimens.

Test marked by about twenty-five strong, regular radii, with broader concave interspaces, and also, in well-preserved specimens, smaller intermediate rays. The specimens described are casts of the interior, and show but faint traces of concentric lines of growth. The ears are mostly free from surface markings.

Pallial line impressed, continuous, situated about one-half the distance between the apex of the beak and the pallial margin of the shell. Muscular impression elliptical, within the concavity of the valves adjacent to the sulcus of the posterior ear. Hinge-ligament without marked characters.

The largest specimen has a height of 29 mm., length 30 mm., and hinge-line about 23 mm. A smaller individual is 23 mm. in height, 23.5 mm. in longitudinal diameter, and hinge-line measuring 19 mm.

This species resembles in some respects *A. ignotus*, and is distinguished by its transverse form, greater obliquity, larger anterior ear in the left valve, rectangular beak, and more regularly alternating rays. Both of these forms are remarkable for the very slight convexity of the left valve.

Formation and localities. In calcareous sandstone of the Upper Chemung group, Randolph and Salamanca, Cattaraugus county, N. Y.

LYRIOPECTEN, Hall.

Lyriopecten parallelodontus.

PLATE IV, FIGS. 1, 2.

Lyriopecten parallelodontus, Hall.	MS. for Pal. N. Y., vol. v. 1877.
" " "	Catalogue Amer. Palæozoic Fossils, S. A. Miller. Cincinnati, 1877.
" " "	Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 4, figs. 1, 2. Jan., 1883.

Shell of medium size, sub-orbicular, not oblique; height somewhat less than the longitudinal diameter; margins regularly rounded.

Right valve moderately convex. Left valve unknown.

Hinge-line straight; anterior portion not preserved in the specimen; from the beak to the extremity of the posterior ear its length is one-half the longitudinal diameter of the shell.

Beak obtuse, rounded, slightly oblique, anterior to the centre of the valve; umbonal region ample.

Posterior ear large, broad-triangular, flat; margin straight or slightly concave; extremity rectangular. Anterior ear not preserved.

Test thin, marked by about 90 regular, alternating, rounded radii, with concave interspaces, and crossed by fine, elevated, sharp, cancellating striæ; these are crowded over the posterior ear, and the rays are there more numerous and less regularly alternating.

The mould of the interior preserves, around the margin, traces of the stronger rays, and shows a moderately impressed pallial line, with apparently an ovate, muscular impression near the umbonal region. Cartilage-pit small, deeply indented. Ligamental area narrow, marked by two or three slender, parallel grooves, extending to the posterior extremity; and one or two shorter, accessory grooves extending for a short distance from the cartilage-pit, and parallel to the longer folds.

The specimen consists of the exterior and interior impression of a right valve; it is 38 mm. in height, 43 mm. in length, and the incomplete hinge-line measures 20 mm. from the beak to the end of the posterior ear.

This species differs from *L. orbiculatus* in its comparatively greater length, the convexity of the right valve, and the regular alternation of the rays. It is remarkable as the only pectenoid form yet observed in the Schoharie grit, while similar forms are numerous in the Upper Helderberg limestone.

Formation and locality. In the Schoharie grit, Albany county, N. Y.

LYRIOPECTEN DARDANUS.

PLATE I, FIG. 5.

Lyriopecten Dardanus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 5. Jan., 1883.

SHELL of medium size, orbicular, transverse axis not oblique; height a little less than the length; margin regularly rounded.

Left valve moderately convex. Right valve unknown.

Hinge-line straight, length nearly equal to the transverse diameter of the valve, extending as far as the posterior margin.

Beak obtuse, rounded, straight, anterior to the middle of the hinge-line and to the centre of the longitudinal diameter.

Anterior ear small, narrow-triangular, flat, separated from the umbo by a broad, undefined sulcus; margin slightly convex above the sinus; extremity rectangular rounded. Posterior ear large, broad-triangular, flat; margin straight or slightly concave, rectangular to the hinge-line; extremity mucronate.

Test marked by about forty strong rounded continuous rays with wider concave or flat interspaces, and sometimes a smaller intermediate ray; crossed by sharp, elevated concentric striæ. The rays are fine and little elevated on the ears, while the concentric striæ are conspicuous.

Interior characters not observed, except an indication of a well-defined ligamental area.

The specimen is 45 mm. in height, 48 mm. in length, and the hinge-line 43 mm.

This species resembles *L. parallelodontus,* but differs in the comparatively larger and more extended posterior ear and fewer and stronger rays, without regular alternation of size. *L. orbiculatus* is more elongate, with more numerous radii and less defined anterior ear.

The figure is from a gutta percha cast of a mould of the exterior of the shell.

Formation and locality. In the limestone of the Upper Helderberg group, Le Roy, Genesee county, N. Y.

Lyriopecten orbiculatus.

PLATE IV, FIGS. 3-8; AND PLATE LXXXII, FIG. 3.

Avicula orbiculata, Hall. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 202. 1843.
Lyriopecten orbiculatus, Hall. MS., vol. v, pt. 1. 1877.
" " " Catalogue Amer. Palæozoic Fossils, S. A. Miller. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 4, figs. 3–8. Jan., 1883.
Not *Aviculopecten orbicularis,* McCoy. Carb. Foss. of Ireland. 1844.
" " *orbiculatus,* " " " " "

Shell large, orbiculate, becoming wider and oblique with age; length and height equal in small and medium individuals; in large specimens the height is sometimes one-ninth greater than the longitudinal diameter; basal and lateral margins full and regularly rounded.

Left valve moderately convex; umbonal region ample. Right valve concave, flat or slightly convex over the umbonal region.

Hinge-line straight, central; length in young shells equal to four-fifths or five-sixths of the longitudinal diameter; and in large specimens the length is sometimes not more than one-half the length of the valve.

Beak obtuse, slightly oblique to the hinge, not rising above it, situated anterior to the middle of the hinge-line, and to the centre of the valve.

Anterior ear of left valve, in small shells, comparatively large, triangular, limits not strongly defined; margin straight or slightly concave; extremity acute-angular; in older shells comparatively narrow, with an obtuse-angular extremity. Anterior ear of the right valve defined by a sulcus, extending to the extremity of the beak; margin convex; extremity rounded. Byssal sinus scarcely indicated on the left valve, forming a deep, angular notch in the right valve. Posterior ear large, broad-triangular; length about two-thirds of the hinge-line; margin concave; extremity acute or right-angled in small specimens, obtuse in larger individuals; limits not defined.

Test thin, thickness nearly .3 mm., ornamented by about 80 rounded radii, with broader concave interspaces, crossed by regular, sharp, elevated, continuous, concentric, foliate expansions of the test, reaching an elevation of about .6 mm. above the general surface. Usually the test shows only the strong rays, with occasionally a reticulation (plate 4, fig. 8), where the concentric folds are only partially preserved. The figure cited represents also the internal mould where the test has been wholly removed.

Ligamental area, in young shells, represented by a slight inflection of the margin of the hinge with a very small longitudinal groove. In more mature specimens this area is wider, the number and strength of the grooves increasing, until they occupy a continuous space between the extremities of the hinge-line, slightly bending outwards at the beak; the inner ridges and grooves do not extend the whole length of the area. Cartilage-pit and muscular impressions not observed.

The original specimen of this species is 38 mm. high, 39 mm. long, hinge-line about 30 mm. Another more nearly entire specimen is 35 mm. high, 37 mm. long, hinge-line 30 mm. The largest specimen observed shows a height of 78 mm., with length nearly equal, and hinge-line 42 mm. In this specimen the longest diameter is 85 mm., measured from a point on the upper anterior margin to the lower posterior margin.

This species is distinguished by its form and surface markings. The characters of surface distinguish it from *L. Priamus* and *L. macrodontus*, though in form it bears some resemblance to the former; and in the ligamental grooves it is similar to the latter.

Pterinopecten suborbicularis, in some of the younger specimens, resembles this species in general aspect; but none of that species have shown a broad, ligamental area, and the ears continue to increase with the growth of the shell.

Formation and localities. In shales of the Hamilton group at Monteith's Point, Canandaigua lake, Ontario county; Moscow, Geneseo and York, Livingston county; and in the shale and Encrinal limestone, along Lake Erie shore, Eighteen-Mile creek, Erie county, N. Y.

LYRIOPECTEN INTERRADIATUS.

PLATE II, FIGS. 1-4; AND PLATE LXXXII, FIG. 5.

Lyriopecten interradiatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 2, figs. 1-4. Jan., 1883.

SHELL large, longitudinally very broadly elliptical; transverse axis somewhat oblique to the hinge-line; height about one-ninth less than the length; margins full and regularly rounded.

Valves about equal in dimensions. Left valve depressed, moderately convex. Right valve flat, or slightly concave below, becoming convex towards the beak.

Hinge-line straight, central to the body of the shell; length less than two-thirds the longitudinal diameter of the shell.

Beak of left valve obtuse, not prominent, directed forward, situated about one-third the length of the hinge-line from the extremity of the anterior ear. In the right valve the umbo is often flat, and the angle subtended by its sides is acute, caused by the deep byssal sinus.

Posterior ears narrow-triangular, distinguished from the gradually sloping sides of the umbo by their flatness and finer markings; margins concave; extremities mucronate. Anterior ear of the left valve smaller, triangular; margins concave; extremity rectangular. Anterior ear of the right valve convex, triangular, truncated at the extremity; separated from the umbo by a deep angular sulcus, and a broad longitudinal semi-elliptical byssal sinus, which forms an indentation in the lateral outline of the body of the shell.

Test of the left valve marked by about 40 strong rounded rays with smaller intermediate implanted rays, crossed by fine, regular, elevated sharp lines of growth, which at intervals are raised into lamellæ, and appear in the cast as strong transverse ridges crossing the radii. The furrows between the radii are narrower than the rays. The regular alternation of the radiating lines where seen is a very conspicuous feature. The right valve is marked by more numerous and subdued rays, and their alternation is somewhat obscure. The ears show fine radiating lines and stronger and more crowded concentric striæ.

The differences between the right and left valves, are the convexity, the surface markings, and the deep byssal sinus of the right valve.

The characters of the interior are not known.

A medium-sized individual has a height of 47 mm., longitudinal diameter 54 mm., hinge-line 32 mm. A smaller specimen measures in height 35 mm., length 38 mm., hinge-line 24 mm.

The largest specimen (imperfect) shows a height of 74 mm., and a length of 88 mm.

In outline and general aspect this species closely resembles *L. macrodontus* (plate 8, figs. 9, 10), but differs in the obliquity of the beak, wider anterior ears, and more elevated and numerous rays. It differs from *L. magnificus* in its outline, larger anterior ears, longer hinge-line, and finer radii of the ears.

The anterior ears of this species, and also of *L. solox* and *L. polydorus*, are smaller than in the species referred to AVICULOPECTEN.

The specimens mostly preserve both valves in connection. A large specimen (plate 82, fig. 5), occurring in the harder argillaceous sandstone, attains nearly the dimensions of *L. cymbalon* (plate 24, fig. 8), but differs conspicuously in the more numerous, strong radii, their gentle curvature toward the anterior side, and the smaller area of surface upon the anterior side of the vertical axis of the valve.

Formation and locality. In the shales of the Hamilton group, Fultonham, Schoharie county, N. Y.

LYRIOPECTEN MACRODONTUS.

PLATE IV, FIG. 9; AND PLATE VIII, FIGS. 9, 10.

Lyriopecten macrodontus, HALL. Cat. Palæozoic Fossils. S. A. MILLER. Cincinnati. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 4, fig. 9; pl. 8, figs. 9, 10. Jan., 1883.

SHELL large, sub-circular; in some large specimens becoming transversely broad-ovate, from the posterior extension of the valve; height from one-sixth to one-eighth less than the length; margins regularly rounded, more convex at the posterior lateral margin, and extending in nearly a straight line to the beak.

Left valve depressed, moderately convex. Right valve unknown.

Hinge-line straight, nearly central, varying in length with the age of the shell.

Beak obtuse, rounded, directed slightly toward the anterior, not rising above the hinge.

Anterior ear small, about one-third the length of the posterior, triangular, not well-defined; margin straight or slightly concave; extremity obtuse. Posterior ear large, triangular, defined by the absence of the strong radii, and by a shallow, undefined depression reaching to the beak; margin deeply sinuate; extremity acuminate.

Surface marked by from 30 to 40 broad, rounded radii, with usually smaller intermediate rays, crossed by fine striæ of growth. Some fragments of shell, adhering to the internal mould, have a thickness of one millimeter.

Muscular impression large, sub-circular, concentrically striated, situated posterior to, and below the umbonal region. Cartilage-pit very small, triangular beneath the apex of the beak, not extending to the hinge margin. Ligamental area usually marked by five strong, elevated ridges, which curve outward at the beak, diverging from, and partially enclosing, the cartilage-pit, and continuing toward the extremities of the ears; the innermost ridges disappear before reaching the extremity of the area.

The largest specimen is 85 mm. high, 98 mm. long, and the hinge-line 50 mm. Another specimen, somewhat different in proportions, is 68 mm. in height, 75 mm. long, with hinge-line of 40 mm.

Compared with *L. magnificus*, this species has greater convexity, less elevated radii, and, in general, a comparatively greater longitudinal diameter. It differs from *L. cymbalon* and *L. tricostatus* in surface ornamentation.

This species, described from only the left valve, is nevertheless so distinctly unlike any others here described that it is readily recognized.

Formation and localities. In the coarse beds of the Hamilton group, at Hamilton, Madison county; and Worcester, Otsego county, N. Y.

LYRIOPECTEN CYMBALON.

◆

PLATE XXIV, FIG. 8.

Lyriopecten cymbalon, HALL. Pal. N. Y., vol. v, pt. 5. Plates and Explanations: Pl. 24, fig. 8. Jan., 1883.

SHELL large, sub-orbicular, not oblique; height a little less than the longitudinal diameter; pallial margin regularly rounded, upper anterior margin more inflated than the posterior, which is truncated toward the beak.

Left valve regularly convex; the basal margin slightly inflected, giving the valve an undue convexity. Right valve not known.

Hinge-line straight, length a little greater than one-half the longitudinal diameter of the shell, and extending about one-third of its length farther to the posterior than to the anterior margin.

Beak obtuse, rounded, straight, central; umbonal region defined by its abrupt antero- and post-cardinal margins, and by its convexity.

Anterior ear very small, narrow-triangular; margin concave; extremity obtuse-angular; byssal notch broad and shallow, not conspicuous. Posterior ear large, triangular, marked by a deep sinus; margin convex; extremity angular; length twice as great as the anterior ear.

Test marked by about twelve very strong, continuous, broad, rounded rays, with from one to six smaller ones of variable strength in each of the flat interspaces; crossed by fine, sharp, regular, concentric striæ of growth, which are elevated into lamellar ridges at irregular intervals. The ears and a broad adjacent space on the body of the valve are destitute of rays, but show strong striæ and undulations of growth. The direction and character of the rays (in the specimen figured) have been affected, apparently, by some injury received during the life of the animal, which has also produced a strong varix of growth.

Ligamental area 1.5 mm. wide at the beak, whence it diminishes towards the extremities of the hinge-line, marked by several flat, longitudinal striæ. Cartilage-pit broad-triangular, situated under the apex.

The specimen described is 75 mm. in height, 88 mm. in longitudinal diameter, and hinge-line 46 mm. The distance between the centres of two of the large rays at the basal margin is about 17 mm.

The surface markings resemble *L. tricostatus*, but they are stronger, more rugose, and the rays less numerous; also the shell is not oblique, and the beak is more obtuse and rounded. It differs from *L. macrodontus* and *L. magnificus* in its greater convexity, deeper byssal sinus, larger posterior ear, and by its surface characters. This remarkably large and fine species shows conspicuously the diminished anterior ear, a feature also seen in *L. tricostatus*, which is the reverse of many species of recent Pectenidæ, where the anterior ears are developed beyond the posterior; as in *Janira longicauda* (D'ORBIGNY), and *Pecten Tranquebaricus* (GMELIN).

This species, although seen in only one valve, is characterized by its peculiar surface markings and outline.

Formation and locality. Hamilton group, from a bowlder found near Elmira, N. Y.

LYRIOPECTEN TRICOSTATUS.

PLATE IV, FIG. 11; PLATE VII, FIG. 26; AND PLATE X, FIGS. 6–12.

Avicula tricostata, VANUXEM. Geolog. Surv. N. Y.: Report of Third Dist., p. 179, fig. 1. 1843.
Lyriopecten tricostatus (VANUXEM), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 4, fig. 11; pl. 7, fig. 26; pl. 10, figs. 6–12. Jan., 1883.

SHELL large, transversely and more or less obliquely broad-ovate; height usually less than the length, the proportions varying with the age of the shell; young specimens are longitudinally elliptical; mature specimens are more oblique; while some abnormal forms show a difference in the direction of the transverse diameter of nearly 45°; margins full, rounded anteriorly, extended on the postero-basal side, and thence following a nearly straight line to the beak.

Valves similar in general outline. Right valve flat or slightly concave. Left valve moderately convex.

Hinge-line straight, central, varying from more than one-half the longitudinal diameter in young specimens, to less than one-half in mature examples.

Beak pointed, depressed, directed forward, situated anterior to the middle of the hinge-line, and not extending as far as the margin of the hinge. Umbonal angle 90°.

Anterior ear small, triangular, usually less than half the length of the posterior one; margin rounded; extremity obtuse; byssal sinus broad, rounded, indenting the body of the shell, and shortening the anterior ear. In the right valve the notch is deeper and more angular. Posterior ear large, flat, triangular, marked by a distinct sinus which increases with the age of the shell; margin above the sinus straight, convex or concave; extremity angular. In young specimens the ears are sub-equal, undefined, and without sinus. In older shells the anterior ear becomes diminished, or appears comparatively smaller; while the posterior ear is increased in size.

Surface ornamented by from 20 to 25 strong, rounded, continuous rays, with broad, flat interspaces which show from three to ten smaller radii; and in well-preserved specimens the entire surface of the shell is marked by fine, regular, sharp, elevated, continuous, concentric lines of growth. In the right valve the finer radiating lines are conspicuous, while the others are obscure and more numerous. The ears do not show the stronger rays, but usually preserve the finer radiating and concentric lines, and are marked by regular, concentric undulations, which are not seen on the body of the valves. The thickness of the test is not known.

The hinge-ligament, in mature specimens, has a width of about 2 mm., and is marked with from four to seven longitudinal, raised lines, or ligamental grooves, diverging from the cartilage-pit, and continuing parallel to the hinge-line; cartilage-pit small, triangular, placed beneath the beak.

The largest specimen yet seen, of the left valve, is 80 mm. in height, 88 mm. in length, and the hinge-line 35 mm.; the distance between the strong rays at the basal margin is 11 mm. A specimen of medium size is 62 mm. in height, 72 mm. in length, hinge-line 39 mm. A young individual is 23 mm. in height, 29 mm. in length, and hinge-line 18 mm.

This species somewhat resembles in outline *L. macrodontus*, but differs in the surface markings, and the finer parallel teeth of the ligamental area. It differs from *L. magnificus*, *L. interradiatus*, and *L. cymbalon* in outline; the surface of the latter species is similar, but more rugose. From *L. Priamus* it differs in form and surface markings.

In comparing many specimens a great diversity in form and ornamentation will be observed.

Formation and localities. In the lower and middle Chemung beds at Barker, Broome county; Big Flats, Chemung Narrows, and Elmira, Chemung county; and Franklin, Delaware county, N. Y.

LYRIOPECTEN POLYDORUS.

PLATE VII, FIG. 25.

Lyriopecten Polydorus, HALL. Pal. N. Y., vol. v, pt. 1 Plates and Explanations: Pl. 7, fig. 25. Jan., 1883.

SHELL of medium size; transversely very broad-obovate; height nearly equalling the longitudinal diameter; pallial margins full, regularly rounded on the posterior side; and the anterior side of the left valve passing in nearly a straight line to the beak.

Left valve depressed, nearly flat. Right valve unknown.

Hinge-line straight, length equal to two-thirds the length of the shell, extending posteriorly nearly as far as the posterior margin of the shell.

Beak pointed, directed forward, central to the body of the shell, and forward of the middle of the hinge-line, rising a little above it. Umbonal angle more than 90°.

Posterior ear narrow-triangular, one-third longer than the anterior, the limits not well-defined, and it appears as an expansion or extension of the posterior side of the umbo; margin concave; extremity mucronate. Anterior ear short-triangular; margin convex; extremity rounded, separated from the umbo by a deep, rounded sulcus, which corresponds to the byssal sinus.

Test ornamented by about 25 irregular, strong, rounded rays, with wider interspaces, marked by two or three smaller lines in each one, and crossed by fine striæ of growth. The surface markings extend over the ears.

Interior not observed.

The valve described is 28 mm. high, and of about the same length, and the hinge-line 18 mm. The length of the posterior ear is 11 mm., and of the anterior ear 7 mm.

This species bears some resemblance to *L. solox*, but differs in the flatness of the valve and less gibbous umbo. In surface character it is similar to *L. tricostatus*, but has fewer intermediate striæ between the stronger rays, which in that species are more simple and rounded; while in other characteristics they are very unlike.

Formation and locality. In argillo-arenaceous slates of the Chemung group near Cassadaga, Chautauqua county, N. Y.

Lyriopecten magnificus.

PLATE VIII, FIG. 8.

Lyriopecten magnificus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 8, fig. 8. Jan., 1883.

Shell very large, nearly circular; height a little less than the longitudinal diameter; basal and lateral margins regularly rounded.

Left valve nearly flat; the greatest convexity is in the centre of the umbonal region. Right valve unknown.

Hinge-line short, straight, length less than one-half the transverse diameter of the valve, extending farther toward the posterior than toward the anterior margin.

Beak obtuse, rounded, central to the body of the shell, depressed, not rising above the hinge-line, nor extending to the hinge-margin; umbonal region moderately convex, not defined laterally.

Anterior ear small, narrow-triangular, not well-defined; extremity very obtuse, rounded; margin slightly concave without a decided byssal sinus. Posterior ear triangular, more than twice the length of the anterior, and defined from the umbonal slope by the absence of the strong radii; extremity acute-angular; margin marked by a broad, rounded sinus.

Test marked by about 40 strong, elevated rays, which are somewhat flattened along their summits; usually alternating with one or two sharp or rounded rays, crossed by very fine, sharp, concentric striæ. The radii gradually diminish in strength towards the ears, where they are represented by elevated, narrow lines.

Ligamental area marked by several longitudinal striæ. Other interior characters not known.

The height of the specimen is 97 mm., length 104 mm., hinge-line 44 mm. Three of the stronger rays occupy a space of 12 mm. at the basal margin.

The specimen described is the impression of the exterior of a left valve; it is quite characteristic and very distinct from other known species in its form and surface markings.

In ornamentation and general outline there is some resemblance between this shell and *L. macrodontus,* but it is less convex, the rays are more elevated, and more sharply defined. The geological horizons of the two species are also widely separated.

Formation and locality. In coarse, arenaceous slates of the Upper Chemung group, at Montrose, Susquehanna county, Penn.

LYRIOPECTEN ANOMIÆFORMIS.

PLATE IV, FIG. 10; PLATE X, FIG. 5; AND PLATE LXXXII, FIG. 2.

Lyriopecten anomiæformis, HALL. MSS. for vol. v, pt. 1. 1877.
" " " Catalogue Amer. Palæozoic Fossils, S. A. MILLER. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 4, fig. 10; pl. 10, fig. 5. Jan., 1883.

SHELL larger than medium size, obliquely elliptical or obovate; height nearly equal to the length; the transverse axis makes an angle of about 45° with the hinge-line; margins regularly rounded anteriorly and along the base, becoming obscurely truncated on the upper postero-lateral portion of the shell.

Left valve slightly convex. Right valve nearly flat.

Hinge-line straight, anterior; length equal to one-half the transverse diameter of the shell.

Beak of left valve obtuse, rounded, oblique, not well-defined, situated anterior to the middle of the hinge, and extending to the hinge-margin, but not rising above it. Beak of right valve scarcely defined.

Anterior ear small, obscure, only indicated by the short portion of the ligamental area anterior to the beak. Posterior ear undefined, triangular; margin straight; extremity obtuse. Byssal sinus in the left valve a small notch; in the right valve a very deep, elliptical sinus.

Test thin, marked on the left valve by numerous fine, thread-like radii, of which every fourth to eighth one is much stronger than the intermediate lines, crossed by fine striæ of growth; the larger rays are about 20 in number. On the right valve the radii are represented by obscure, undulating, unequal striæ. The ears show the same surface markings.

Cartilage-pit small. Ligamental area thickened, with about eight flat, longitudinal lines extending to the extremities of the hinge.

A left valve measures 62 mm. from the anterior ear to the postero-basal margin; from the extremity of the beak the height is 55 mm., and the length, parallel to the hinge, is about 54 mm.; hinge-line 27 mm.

The right valve is imperfect, but appears to have been more circular in outline than the left.

This species is characterized by its form, surface ornamentation, and marked resemblance between its right valve and the lower valves of some species of the recent genus ANOMIA, in the flatness of the valve and deep byssal sinus.

Formation and locality. In the slates of the Chemung group, at Chemung Narrows, Chemung county, N. Y.

LYRIOPECTEN PRIAMUS.

PLATE X, FIGS. 1, 2.

Lyriopecten Priamus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 10, figs. 1, 2. Jan., 1883.

SHELL large, transversely broadly elliptical or ovate, wider below; transverse axis normal or very slightly oblique to the hinge-line; height less than one-tenth greater than the longitudinal diameter; margins regularly rounded.

Left valve moderately and symmetrically convex. Right valve unknown.

Hinge-line straight, sub-central; length about one-half the longitudinal diameter of the shell.

Beak obtuse, rounded, oblique, anterior to the transverse axis, not rising above nor extending as far as the hinge-margin.

Anterior ear small and undefined. Posterior ear broad-triangular, flat; margin concave; extremity angular. Byssal sinus not defined.

Test marked by about 40 strong, rounded, irregular radii with narrow interspaces, crossed by fine striæ of growth. The rays are often composed of fascicles of thread-like striæ, and bifurcate at some point of their length. On the posterior ear the rays are subdued and finer.

Ligamental area 2.5 mm. wide in mature specimens, and marked by numerous sharp, elevated, parallel, longitudinal striæ extending to the extremities of the hinge-line. Cartilage-pit triangular, narrow, situated at the apex of the beak, and extending to the margin of the hinge.

One large specimen, which is a cast of the interior, measures 72 mm. in height, 70 mm. in length; hinge-line 32 mm. A smaller specimen, showing the exterior, is 63 mm. in height, 57 mm. in longitudinal diameter, and hinge-line about 31 mm.

In general appearance of surface this shell is similar to *L. macrodontus*, but the details are quite different.

This species, though characterized from the left valve only, is distinctly different from the others in form and surface ornamentation.

Formation and locality. Associated with numerous segments of crinoidal columns, and rarely with any other fossils, in the upper part of the Chemung group, at Franklin, Delaware county, N. Y.

LYRIOPECTEN FASCIATUS.

PLATE IX, FIGS. 10, 11.

Pernopecten fasciculatus, HALL. MS., vol. v, pt. 1. 1877.
" " " Catalogue Amer. Palæozoic Fossils, MILLER, p. 200. 1877.
Not *Aviculopecten fasciculatus*, HALL.
Lyriopecten fasciatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 10, 11. Jan., 1883.

SHELL of medium size, very broadly ovate, erect; length a little less than the width; margins regularly rounded.

Right valve convex, the greatest convexity one-third the width of the valve from the beak. Left valve unknown.

Hinge-line short, straight.

Beak acute, erect, prominent; umbonal region distinctly defined, subtending a right angle.

Anterior ear small, scarcely defined, about half the length of the posterior one. Posterior ear triangular, defined by a well-marked sulcus; margin nearly straight; extremity obtuse. Byssal sinus shallow.

Surface ornamented by strong, low, broad, rounded radii, which increase by interstitial addition; and numerous sharp, elevated, radiating striæ mark the surfaces of the rays, giving them a distinctly fasciculated aspect. These also mark the interspaces, which are narrower than the large rays. Sharp, regular, concentric striæ cancellate the radii. The ears are marked only by the concentric striæ, which are less prominent than on the body of the valve.

Internal characters not known.

The specimen described, is a right valve, having a length of 34 mm., height 36 mm., and hinge-line about 10 mm.

In outline and surface characters this species resembles *L. Priamus*, but the valve is more convex than the specimen referred to the right valve of that species; it is also less oblique, and the beak more elevated and erect. The rays of *L. Priamus* are distinctly and frequently bifurcating, while in this species the fasciculate appearance is due to the sharp, elevated striæ upon the stronger rays.

Formation and locality. Chemung group, Leon, Cattaraugus county, N. Y.

LYRIOPECTEN SOLOX.

PLATE XXIV, FIG. 5.

Lyriopecten solox, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, fig. 5. Jan., 1883.

SHELL of medium size, nearly circular; transverse axis not inclined to the hinge-line; margin regularly rounded, and sloping somewhat abruptly into the byssal sinus.

Right valve moderately convex. Left valve unknown.

Hinge-line straight, length about one-half the diameter of the shell, extending farther on the anterior side.

Beak obtuse, rounded, central, not rising above the hinge-line, directed slightly forward; umbo ample.

Posterior ear triangular, defined by its flattened surface, and the rapid umbonal slope; margin concave; extremity rectangular. Anterior ear imperfect, but showing a very deep and narrow byssal sinus.

Test marked by numerous fine, angular rays, which are arranged in about 40 regular, rounded plications, composed of fascicles of finer rays, with defined interspaces. Finer obscure rays mark the umbo, and the posterior ear shows three or four rounded undulations with lines of growth.

Interior not known, except the ligamental area, which is narrow, and makes an inflection of the hinge-margin of the ears.

The dimensions of the right valve described are as follows: height 43 mm., longitudinal diameter 42 mm., and hinge-line apparently about 25 mm.

This species differs from *L. Polydorus* by its circular outline, convexity, obtuse beak, ample umbo and surface characters. It differs from *L. magnificus* and *L. macrodontus* in the greater convexity of the valve and fullness of the umbo, as well as in the character of the rays. It is also much smaller than those species.

Formation and locality. In a fine semi-calcareous, argillaceous sandstone (lying above the conglomerate ?) of the Upper Chemung group, near Panama, Chautauqua county, N. Y.

PTERINOPECTEN, HALL.

PTERINOPECTEN MULTIRADIATUS.

PLATE I, FIGS. 6, 7.

Pterinopecten multiradiatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, figs. 6, 7. Jan., 1883.

SHELL large, rhomboidal, body of the valve longitudinally obovate; length and height nearly as five to four; anterior and basal margins regularly curved, the postero-basal margin produced and the body of the shell extending thence in a direct line to the beak.

Left valve moderately and regularly convex. Right valve unknown.

Hinge-line straight, anterior, less than the length of the shell.

Beak obtuse, rounded, directed forward, slightly rising above the hinge. Umbonal region ample, subtending an angle of about 105°.

Ears triangular, flat, moderately well-defined; margins slightly concave; extremities rectangular. Posterior ear about twice the size of the anterior, limited by a stronger ray and the abrupt post-cardinal slope of the valve. The anterior ear is limited by a distinct but undefined sulcus. Byssal sinus scarcely marked.

Surface ornamented by numerous strong, distant, elevated, rounded rays, with interspaces marked by a strong ray in the centre, and several finer ones on each side, producing two series of alternations. Concentric striæ obscure. The arrangement of the rays gives the surface a fasciculate aspect, especially marked in the impression of the exterior. The rays on the posterior ear are sharp and simple, while on the anterior ear they are similar to those on the body of the shell.

Interior not observed.

The specimen has a length of 48 mm., height 35 mm., hinge-line about 36 mm.

This species is distinguished from *P. suborbicularis* by its greater length and doubly alternating radii. Though somewhat similar in form to *P. crenicostatus*, the surface characters are very different.

Formation and locality. In Corniferous limestone at Stafford, Genesee county, N. Y.

PTERINOPECTEN REFLEXUS, n. sp.

PLATE LXXXII, FIG. 8.

SHELL of medium size, rhomboidal, moderately oblique; length one-sixth greater than the height; outline regularly curved to the postero-basal margin, thence extending posteriorly.

Left valve depressed-convex; margin reflexed. Right valve unknown.

Hinge-line straight, extended posteriorly, exceeding the greatest length of the shell.

Beak obtuse, low, rounded, directed forward. Umbonal region convex, subtending an obtuse angle.

Posterior ear large, flat, triangular, scarcely defined from the umbo; margin slightly convex; extremity obtuse. Anterior ear small, triangular, convex, limited by an undefined sulcus and a shallow byssal sinus; margin nearly straight; extremity obtuse.

Test marked by fine, rounded striæ, alternating with finer lines; intermediate spaces flat. The same surface marking continues in a subdued degree upon the posterior ear, and somewhat more strongly on the anterior slope and anterior ear.

Internal characters unknown.

The specimen figured has a length, across the middle, of 18 mm., height 15 mm., hinge-line 22.5 mm.

In form, this species resembles *P. Hermes*, but is distinct in its smaller and less defined anterior ear, less strong radii, and more depressed beak. It is much flatter and of different proportions from *P. exfoliatus*.

Formation and locality. In the Corniferous limestone at the Falls of the Ohio, near Louisville, Ky.

PTERINOPECTEN INSONS.

PLATE I, FIG. 4.

Pterinopecten insons, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 4. Jan., 1883.

SHELL small, rhomboidal, slightly oblique; length somewhat greater than the height; basal margin regularly rounded; the anterior and posterior sides become nearly vertical as they approach the ears.

Left valve convex, the greatest convexity near the beak. Right valve unknown.

Hinge-line straight, length one-fourth greater than the length of the shell, extended posteriorly.

Beak acute, prominent, anterior to the middle of the hinge, directed forward. Umbonal region prominent, subtending a right angle.

Ears triangular; margins straight; extremities acute. Posterior ear large, undefined. Anterior ear small, convex, with an undefined fold below the cardinal margin, limited by a distinct rounded sulcus. Byssal sinus slightly marked.

Test (in a partially exfoliated specimen) marked by regular, sharp, not numerous rays, with broad, flat interspaces, which, in a perfect condition, have probably been marked by fine striæ. The rays are obsolete over the posterior slope of the valve and the umbo, and also not preserved on either of the ears.

Interior not observed. Ligamental area narrow, appearing as a simple fold of the hinge-margin.

The specimen has a length of 13 mm., height 11 mm., hinge-line 16.5 mm.

In some of the modes of occurrence, this species resembles *P. exfoliatus*, but differs in its proportionally longer hinge-line, more extended posterior ear, comparatively larger anterior ear, and the greatest convexity is nearer the beak.

Formation and locality. Upper Helderberg limestone, Western New York. The particular locality unknown.

PTERINOPECTEN NODOSUS, n. sp.

PLATE LXXXII, FIG. 13.

SHELL small, sub-rhomboidal, slightly oblique; form not fully known.

Left valve very convex.

Beak prominent, nearly erect. Umbonal region very prominent, the limits distinct on the anterior and obscure on the posterior side; subtending an acute angle.

Posterior ear large, triangular; margin very slightly concave; extremity angular. Anterior ear not preserved in the specimen.

Test thin, marked (in a partially exfoliated specimen) by strong, rounded rays with intermediate finer ones, and fine, concentric, undulating, elevated striæ, with numerous concentric undulations, which increase in frequency from the beak to the margin, and on crossing the larger rays, are elevated into strong nodes. On the posterior ear the rays are fine, equal and continuous.

Interior characters unknown.

This species is described from an imperfect specimen of the left valve; but it is so remarkable in its nodose undulations that it is readily distinguished from every other form.

Formation and locality. In the Corniferous limestone at the Falls of the Ohio, near Louisville, Ky.

PTERINOPECTEN EXFOLIATUS.

PLATE I, FIGS. 16, 17; AND PLATE LXXXIII, FIGS. 6, 7.

Pterinopecten exfoliatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, figs. 16, 17. Jan., 1883.

SHELL of less than medium size, sub-rhomboidal; body obliquely ovate; length somewhat greater than the height; pallial margins regularly rounded from the anterior ear to the base of the posterior slope, from whence the margin is nearly straight or slightly concave to the extremity of the hinge.

Left valve very convex, inclined to gibbosity. Right valve moderately convex, much smaller than the left.

Hinge-line straight, a little longer than the greatest length of the shell, extended posteriorly.

Beak of left valve prominent, sub-acute, anterior to the middle of, and arching over the hinge-line, directed forward. Umbo prominent, gibbous, the greatest convexity being about the middle of the width, subtending a right angle.

Ears triangular. Posterior ear large, undefined; margin slightly concave; extremity somewhat acute. Anterior ear small, convex, defined by a deep, obtuse sulcus; margin convex; extremity acutely rounded. Byssal sinus distinct, somewhat deep.

Test thin; marked in the left valve by fine, regular, radiating striæ with flat interspaces which show one or two finer rays; crossed by concentric lines of growth and stronger undulations, which in old shells become very prominent. The rays are continued over the ears, and are somewhat subdued and less distinctly alternating on the posterior ears, and obsolete over the upper part of the umbo. The right valve is marked by obsolescent rays and concentric undulations.

Ligamental area narrow.

Three specimens measure respectively as follows: Length 17, 20 and 22 mm., height 15, 18 and 18 mm., length of hinge-line 18, 21 and 23 mm.

In the exfoliated condition, this species resembles *P. insons;* but has a comparatively shorter hinge-line, smaller anterior ear, deeper byssal sinus, and less extended posterior ear. It is more gibbous and less oblique than *P. Hermes*, with less conspicuous striæ.

The specimens are usually in the condition of partially exfoliated casts, and retain marks of only the stronger radii and concentric undulations. The differences between the internal mould and the impression of the exterior of the shell are represented in figs. 6, 7, of pl. lxxxiii. This species is not uncommon in the central and western portions of the State.

Formation and localities. In a limestone bed of the Marcellus shale at Avon, Livingston county, Stafford, Genesee county, and Vienna, Ontario county, N. Y.

PTERINOPECTEN DIGNATUS.

PLATE I, FIGS 12, 14, 15.

Pterinopecten dignatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, figs. 12, 14, 15. Jan., 1883.

SHELL small, sub-rhomboidal, very slightly oblique; length and height as three to four; pallial margins regularly rounded, somewhat more produced on the postero-lateral portion.

Left valve moderately convex. Right valve depressed, flatter and smaller than the left; it differs in surface markings and depth of byssal notch, and is apparently thinner and more delicate.

Hinge-line straight, length equalling, or greater than, the greatest length of the shell, extending anteriorly beyond the margin of the valve.

Beaks obtuse, rounded, anterior to the centre of the hinge-line, directed slightly forward. Umbonal region ample, subtending an acute angle.

Ears triangular, flat. The posterior ear larger and less distinctly defined than the anterior; margin straight or slightly concave; extremity rectangular. Anterior ear rounded; margin convex; extremity acute-angular. Byssal sinus moderate in the left valve; deep, narrow and angular in the right valve.

Test of the left valve marked by numerous strong, rounded, increasing radii, with broader interspaces, containing one or two smaller rays which originate about the middle of the valve; crossed by fine, sharply elevated, concentric striæ. The right valve is marked by fine, sub-equal, regular, radiating striæ, which increase by interstitial addition, and become obsolete on the upper part of the umbo. The radii are also seen on the ears.

Internal characters not observed.

The largest specimen has a length of 19 mm., height 15 mm., hinge-line 19 mm. Another specimen measures 17 mm. in length, 14 mm. in height, with the hinge-line 18.5 mm.

This species closely resembles *P. lætus*, but differs in being less oblique, with greater height, more acute beak, fewer and stronger radii, and a characteristic concentric marking. From *P. Hermes* it differs in being less oblique, with the posterior ear less extended, and with finer rays upon the ears. From *P. conspectus* it differs in its greater length, and distinctly different surface markings of the left valve.

Formation and locality. In the Marcellus shale at Bloomfield, Ontario county, N. Y.

PTERINOPECTEN LÆTUS, n. sp.

PLATE I, FIG. 13.

Pterinopecten lautus (in error), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 1, fig. 13. Jan., 1883.

SHELL small, sub-rhomboidal, regularly rounded; length one-sixth less than the height.

Left valve depressed-convex. Right valve unknown.

Hinge-line straight, longer than the greatest length of the valve, extended anteriorly beyond the margin of the shell.

Beak obtuse, anterior to the middle, directed forward, not prominent. Umbonal region scarcely defined, subtending about a right angle.

Ears unequal, triangular. Posterior ear much the larger, undefined; margin very slightly concave; extremity rectangular. Anterior ear smaller, not distinctly defined from the body of the shell; margin above the sinus convex; extremity acute. Byssal sinus moderate.

Entire surface marked by distinct, close, rounded, duplicating radii, crossed by fine, concentric lines of growth. The surface of the umbonal region is wrinkled from the apex to below the middle of the valve. The surface markings are finer and sub-equal over the posterior ear. A small space on the umbo, as in *Aviculopecten bellus,* is destitute of radii.

Internal characters not known.

This species differs from *P. Hermes* in its less oblique form, shorter hinge-line, less ample umbo, and in having no regular alternation in the rays, which are closer and more rounded. It is associated with, and closely allied to, *P. dignatus,* but differs by its more obtuse beak, longer outline, and comparatively more frequent and smaller rays, without the regular concentric striæ.

Formation and locality. In the Marcellus shale at Bloomfield, Ontario county, N. Y.

PTERINOPECTEN HERMES.

PLATE XVII, FIGS. 13–15.

Pterinopecten Hermes, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, figs. 13–15. Jan., 1883.

SHELL less than medium size, sub-rhomboidal, obliquely sub-ovate; length and height about as three to four; pallial margins regularly rounded, becoming straight on the post-cardinal slope at the junction with the ear.

Left valve moderately convex. Right valve not determined.

Beak acute, prominent, anterior to the middle of the shell directed forward. Umbonal region ample, subtending an angle of about 80°.

Ears very unequal, triangular. Posterior ear much the larger, scarcely defined; margin concave; extremity acute. Anterior ear small, slightly convex, defined by a distinct sulcus; margin convex; extremity rounded. Byssal sinus deep.

Test marked by regular, rounded striæ, with wider interspaces which, on the posterior part of the valve, show finer intermediate rays. The ears have essentially the same surface characters as the body of the valve. The entire surface is marked by fine concentric striæ. Umbo with concentric wrinkles. Partial casts of the interior show the same characters as the exterior, but show no muscular or pallial markings.

The largest specimen has a length of 19 mm., height 29 mm., hinge-line 29 mm.

This species is very similar in form to *P. lætus;* but the hinge-line is proportionally longer and the radii stronger and more distinctly alternating. It differs from *P. dignatus* in its more oblique form, proportionally greater diameter and sharper radii. From *P. conspectus* it differs in being much more oblique in outline and comparatively narrower.

Formation and locality. In shales of the Hamilton group, Ontario county, N. Y.

PTERINOPECTEN SPONDYLUS.

PLATE XVII, FIG. 16.

Pterinopecten spondylus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, fig. 16. Jan., 1883.

SHELL small, sub-rhomboidal, scarcely oblique; body of the shell ovate; length somewhat greater than the height; pallial margins regularly rounded, becoming straight on the posterior slope, which is continuous with the margin of the ear.

Left valve convex. Right valve not known.

Hinge-line straight, length greater than the longitudinal diameter of the shell, extended anteriorly.

Beak obtuse, rounded, directed forward, situated anterior to the middle of the hinge-line. Umbonal region prominent, but not strongly defined on the posterior slope; subtending an acute angle.

Ears broad, triangular, flat. Posterior ear much the larger, scarcely defined; margin slightly concave; extremity rectangular. Anterior ear defined by a distinct sulcus; margin convex; extremity rounded. Byssal sinus shallow.

Test marked by regular, sharp elevated rays, with broader interspaces which are marked by finer rays, and concentric foliate lamellæ of growth, which are bent backward in crossing the rays, forming short semi-tubular spines. The radii are less conspicuous on the ears, which also show a few concentric undulations.

Internal characters not preserved. The ligamental area appears as a simple fold in the hinge.

The specimen has a length of 15 mm.; height 13.5 mm.; hinge-line 18 mm.

This species has the general form and aspect of *P. Hermes* and *P. lætus*, but is proportionally wider, with different and characteristic surface markings.

Formation and locality. In soft shales of the upper part of the Hamilton group, shore of Canandaigua lake, Ontario county, N. Y.

PTERINOPECTEN CONSPECTUS.

PLATE XVII, FIGS. 17, 18, 20, 21.

Pterinopecten conspectus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, figs. 17–21. Jan., 1883.

SHELL of medium size, sub-rhomboidal; moderately oblique in young shells, scarcely oblique in older ones; length and height about equal, the length usually a little greater; pallial margins regularly rounded, straighter posteriorly, and merging into the ear without definite limitation.

Left valve moderately convex. Right valve nearly flat, narrower and oblique, with a deeper byssal sinus.

Hinge-line straight, nearly central, equalling, or a little greater than, the length of the shell.

Beak sub-acute, anterior to the centre of the hinge-line, directed slightly forward. Umbonal region somewhat prominent, subtending an angle of about 75°.

Ears triangular. Posterior one much the larger, not distinctly defined on the valve; margin slightly concave; extremity rectangular or somewhat acute. Anterior ear small, distinctly defined by a rounded sulcus; margin convex; extremity rounded or sub-angular. Byssal sinus moderate in the left valve; deep and angular in the right valve, as seen in the specimen figured.

Test of the left valve marked by comparatively few, strong, rounded radii, with intermediate smaller ones, crossed by fine concentric striæ of growth, and strong undulations which interrupt the continuity of the radii. Right valve marked by numerous sub-equal radiating striæ which are somewhat obsolete near the beak, and the umbonal region is marked by some strong concentric wrinkles. The ears present, in a less degree, the same ornamentation as the body of the shell.

Internal characters not observed. Ligamental area simple.

A mature specimen is 27 mm. in length and height, and the hinge-line 28 mm.

This species differs from *P. dignatus* in being less oblique, the anterior ear less extended, and the radii sharper and more interrupted. It differs from *P. lætus* and *P. Hermes* in the less obliquity and the stronger surface markings. It differs from *P. invalidus*, which is similar in general aspect, in being wider, and the margin of the posterior ear less concave.

Formation and localities. In the Hamilton group at Norton's Landing, Cayuga lake, and shores of Skaneateles lake, N. Y.

PTERINOPECTEN FILITEXTUS.

PLATE XVII, FIG. 22; AND PLATE LXXXII, FIGS. 9, 10.

Pterinopecten filitextus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, fig. 22. Jan., 1883.

SHELL larger than medium size, transversely semi-elliptical, scarcely oblique; length somewhat greater than the height; margins regularly rounded, less convex on the posterior side.

Left valve moderately convex. Right valve flat or concave.

Hinge-line straight, about as long as the length of the shell, not extended anteriorly beyond the margin.

Beaks obtuse, anterior to the middle of the valve, directed forward, not well defined. Umbonal region not strongly marked.

Ears unequal. Posterior ear wide-triangular, extending as far as the margin of the shell, its limits undefined; margin nearly straight; extremity rectangular. Anterior ear small, limited by a strong sulcus; margin concave; extremity obtuse. Byssal sinus in the left valve moderate; in the right valve well-marked.

Test of right valve thin, marked by fine filiform radii, with much wider interspaces which are marked by finer rays; the same character continuing on the posterior ear, with more equal rays. The entire surface is marked by fine, close, concentric lines of growth, with lamellose elevations at unequal intervals.

Hinge-ligament marked by several parallel grooves.

A right valve measures approximately 35 mm. in length, and 29 mm. in height.

In general form this species resembles *P. conspectus*, but is proportionally longer, and the surface markings are different.

Formation and localities. In the Hamilton group near Cardiff, Onondaga county, and from a bowlder of Hamilton shale at Pine Valley, Chemung county, N. Y.

PTERINOPECTEN INTERMEDIUS, n. sp.

PLATE XVII, FIG. 19; AND PLATE LXXXIII, FIGS. 4, 5.

Pterinopecten conspectus, in part, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, fig. 19, Jan., 1883.

SHELL of medium size, sub-rhomboidal, oblique; length one-fourth greater than the height; margins regularly rounded, more convex on the post-basal side.

Left valve convex, greatest convexity below the umbo. Right valve unknown.

Hinge-line straight, somewhat anterior; length greater than the length of the valve.

Beak acute, well defined, arching over the hinge, directed forward, situated anterior to the middle of the shell and of the hinge-line.

Anterior ear small, triangular, with a longitudinal fold; limited by a broad sulcus; margin slightly convex; extremity acute. Posterior ear large, broad-triangular, undefined; margin slightly concave, extending at right angles to the hinge, to the post-basal side of the valve; extremity angular. Byssal sinus broad in the left valve.

Test thin, marked by fine, alternating, filiform, radiating striæ, which increase by implantation until they are very numerous at the basal margins of some specimens, crossed by fine lines of growth with a few concentric undulations. The ears preserve the same surface characters in a subdued degree. Many of the specimens are exfoliated and the surface markings are very obscure or obsolete.

The characters of the interior have not been observed.

A specimen of the left valve has a length of 14 mm., height 12 mm., hinge-line 16 mm. A larger example has a length of 19 mm., height 16 mm., and hinge-line 21 mm.

This species was arranged with *P. conspectus*. The recent study and comparison of a more numerous series of specimens shows several important differences, and necessitates the removal of this form from that species.

The present species is more oblique, narrower, and the posterior ear is comparatively longer than in authentic forms of *P. conspectus*.

In *P. Hermes* the hinge-line is more extended posteriorly, and the umbonal angle more obtuse, while in *P. regularis* the hinge is shorter, the extremity of the posterior ear rounded, and the margin continuous with the curvature of the pallial margin of the valve.

Formation and localities. In the shales of the Hamilton group at Ludlowville, Tompkins county, and on the shores of Cayuga and Canandaigua lakes, N. Y.

PTERINOPECTEN REGULARIS, n. sp.

PLATE LXXXIII, FIG. 1.

SHELL of medium size, semi-circular, body of the valve oblique; length nearly one-fifth greater than the height, greatest length above the middle; margins very full and regularly rounded from the byssal sinus to the posterior extremity of the hinge.

Left valve moderately convex. Right valve unknown.

Hinge line straight, anterior; length a little greater than the length of the valve.

Beak of left valve acute, directed forward, situated anterior to the middle of the hinge.

Anterior ear small, triangular, more than half as long as the posterior ear, limited by a broad sulcus; margin convex; extremity rounded. Posterior ear large and undefined from the body of the valve; margin convex, in regular continuation with the pallial margin; extremity obtuse, angular. Byssal sinus broad.

Test thin, marked with numerous fine, alternating, filiform, elevated striæ which are crossed by irregular lines of growth. The ornamentation of the ears is somewhat more subdued than on the body of the valve.

Muscular impression small, ovate, situated below the middle of the post-cardinal slope.

A specimen of the left valve has a length of 24 mm., height 19 mm., hinge-line 25 mm. A larger example measures 30 mm. in length.

This species is distinguished for the regular continuous convex curvature of the outline from the byssal sinus to the posterior extremity of the hinge. In this respect it differs from any other form of this genus here described. The right valve of *P. filitextus* has a similar outline, but the left valve has been shown to have the margin of the posterior ear concave and the extremity acute-angular. The specimen of the right valve of that species, figured in fig. 22 of pl. 17, is imperfect at the posterior extremity of the hinge, and thus resembles the present form more than it would if properly restored.

Formation and localities. In the shales of the Hamilton group, between Geneseo and Avon, and at Delphi, N. Y.

PTERINOPECTEN VERTUMNUS.

PLATE V, FIGS. 1–8; AND PLATE LXXXIII, FIGS. 2, 3.

Pterinopecten Vertumnus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 5, figs. 1–8. Jan., 1883.

SHELL large, rhomboidal, oblique; greatest length below the middle of the valve; length about one-fifth greater than the height; margins regularly rounded, becoming full behind and sloping rapidly to the hinge-line.

Left valve depressed-convex. Right valve nearly flat.

Hinge-line straight, somewhat shorter than the length of the shell.

Beaks obtuse, low, anterior to the middle of the hinge-line, directed forward. Umbonal region moderately convex in the left valve, depressed in the right valve, limits defined anteriorly, but not posteriorly.

Ears triangular, flat. Posterior ear much the larger, not defined from the body of the valve; margin gently concave; extremity acute. Anterior ear small, separated from the umbo by an undefined sulcus, and in the right valve by the marked, angular byssal sinus; margin concave; extremity acute, sometimes rounded.

Surface of left valve marked by irregularly alternating, strong, flexuous, flattened radii; interspaces flat; crossed by sharp, elevated, concentric striæ which are more closely arranged towards the margin of the shell. The same character of surface continues over the ears, and on the posterior ear the radii are finer, nearly equal in strength, and crenulated by the concentric striæ. On the right valve the rays are more equal and finer than on the opposite valve; conspicuous on the posterior ears and subdued on the anterior.

Three specimens have respectively the following dimensions: length 38, 40, 41 mm., height 30, 33, 29 mm., hinge-line 35, 35, 32 mm.

This species resembles *Pterinea reprobus*, from the shales of the Chemung group at Ithaca, which has straighter and more rounded radii in the left valve, with sharper intermediate radii and more elevated, undulating, concentric striæ. The right valve of that species is more convex with stronger and often duplicating radii; while the byssal sinus is less distinctly marked. The present species differs from *Pterinopecten dispandus* in its greater length, proportionally longer hinge-line, less strongly marked right valve, and want of duplication in the radii.

Formation and locality. This species is common in the shales of the Hamilton group at Bear gulf, Schoharie county, N. Y.

PTERINOPECTEN UNDOSUS.

PLATE II, FIGS. 10-19; AND PLATE LXXXII, FIG. 7.

Aviculopecten undulatus, HALL. MS. 1877.
" " " Cat. Amer. Palæozoic Fossils. S. A. MILLER. 1877.
Not *Pecten undulatus*, McCOY. Carb. Foss. of Ireland, p. 101, pl. xvii, fig. 12. 1844.
Not *Aviculopecten undulatus*, McCOY. 1853.
Pterinopecten undosus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 2, figs. 10-19. Jan., 1883.

SHELL larger than medium, rhomboidal or sub-orbicular; left valve moderately oblique; right valve scarcely oblique; length one-third greater than the height, proportionally shorter in young shells and in the right valve; anterior and basal margins regularly rounded, somewhat produced behind, and receding rapidly toward the hinge-line.

Valves nearly equally convex; the right valve a little less convex, more orbicular in outline, with deep byssal notch, and different surface markings. When occurring in the softer shales, the valves are often depressed-convex.

Hinge-line straight, length a little less than the height of the shell, nearly central.

Beak obtuse, rounded, scarcely rising above the hinge-line, anterior to the middle of the shell, inclined forward. Umbonal region ample, well-defined, subtending a very obtuse angle.

Ears sub-equal, triangular, undefined; margins concave. Anterior ear limited by a sulcus and shallow sinus; extremity acute. In the right valve sub-triangular; margin rounded, defined by an abrupt sulcus and a deep, angular byssal notch, which encroaches on the body of the valve. In the posterior ear the extremity is obtuse in the left valve, somewhat more pointed in the right valve.

Test thin, marked by numerous fasciculate rays, which increase by interstitial addition, with interspaces varying from nearly equal to several times the width of the rays; cancellated and sometimes crenulated by elevated, lamellose striæ of growth; and by from three to ten strong, concentric undulations, which are rounded upon the summits. The markings on the ears are similar to those on the body of the shell; the rays on the anterior ear are sometimes obscured by the striæ of growth.

Interior not known. Ligamental area narrow.

A left valve has a length of 51 mm., height 36 mm., hinge-line 36 mm. A right valve has a length of 44 mm., height 37 mm., hinge-line 35 mm. A young specimen has the following dimensions: length 23 mm., height 19 mm., hinge-line 20 mm.

This species is distinctly characterized by the strong, concentric wrinkles, the deep byssal sinus of the right valve, and by the form of the shell. Specimens vary in the frequency and elevation of the radii, and in the number and prominence of the concentric undulations.

The specimens are casts of the interior, with scarcely any remaining test. The surface markings are therefore subdued, and the concentric striæ are often not at all preserved.

This species is widely distributed. It has been found in the Corniferous limestone at a single locality; and in the soft shales of the Hamilton group throughout the western portion of the State.

Formations and localities. In the Corniferous limestone at Clarence Hollow, Erie county; in shales of the Hamilton group at numerous localities in Central and Western New York.

PTERINOPECTEN (AVICULOPECTEN ?) STRICTUS.

PLATE XXIV, FIG. 2; AND PLATE LXXXI, FIG. 18.

Pterinopecten strictus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, fig. 2. Jan., 1883.

SHELL of medium size, transversely semi-elliptical, not oblique; body of the shell ovate, length one-sixth less than the height; anterior and basal margins rounded; posterior margin straight.

Left valve moderately convex. Right valve flat.

Hinge-line straight, equal to the length of the shell, central as regards the transverse axis.

Beaks obtuse, low, directed slightly forward, anterior to the middle of the hinge-line. Umbonal region moderately prominent in the upper part, subtending an acute angle.

Ears triangular. Posterior ear much the larger, flat; margin concave; extremity slightly acute, obscurely defined. Anterior ear small, convex, defined by a well-marked groove or sulcus; margin rounded; extremity acute. Byssal sinus distinct in the left valve, and a deep rounded notch in the right valve.

Test of left valve marked by alternating stronger and finer rounded radii, crossed by sharp, elevated, concentric lines of growth and more distant undulations, with imbricating lamellose lines. These markings are continued over the ears, much subdued on the right valve, and obsolete upon the umbo.

Ligamental area marked by two or three furrows, and a central cartilage-pit.

The specimen figured has a length of 25 mm., height 30 mm., hinge-line 25.5 mm.

This species is doubtfully arranged with the present group of forms. In some aspects it resembles *P. conspectus*, but is specifically very distinct. It might be compared with the young of some large forms of LYRIOPECTEN or with AVICULOPECTEN, but the extent of the hinge-line, and the undefined limitation of the posterior ears, do not assimilate it with the ordinary characters ascribed to those genera.

Formation and locality. In the Chemung group near Elmira, N. Y.

PTERINOPECTEN IMBECILIS.

PLATE XXIV, FIG. 1.

Pterinopecten imbecilis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, fig. 1. Jan., 1883.

SHELL small, rhomboidal, oblique, much longer than high; anterior and basal margins rounded; posterior margin produced.

Left valve moderately convex. Right valve not known.

Hinge-line equal to, or greater than, the length of the body of the shell.

Beak obtuse, directed forward, rather prominent. Umbonal region ample, defined anteriorly; subtending an angle of about 90°.

Ears very unequal, triangular. Anterior ear small, defined by a distinct sulcus. Posterior ear large, undefined; margin concave; extremity angular.

Surface marked by numerous strong, simple radii, with wider interspaces which have usually finer intermediate radii; crossed by fine, equal concentric lines of growth, and stronger, more distant lamellæ, which are elevated and arched backwards over the larger rays, producing nodes.

Internal characters not preserved.

The specimen has a length of 15 mm., height 11 mm., hinge-line about 15 mm.

This species differs from *P. lætus*, by its distinct and widely separated rays, and more oblique outline.

Formation and locality. In the Chemung group at Tioga, Tioga county, Pennsylvania.

PTERINOPECTEN DISPANDUS, n. sp.

PLATE LXXXII, FIGS. 11, 12.

SHELL large, somewhat rhomboid-ovate, oblique, varying with the age of the shell; length a little greater than the height; margins regularly curved, extending behind.

Left valve convex. Right valve depressed-convex, somewhat smaller than the left, and proportionally longer.

Hinge-line straight, less than the greatest length of the shell, nearly central.

Beaks obtuse, little elevated, anterior to the middle, directed forward. Umbonal region scarcely defined, moderately prominent, subtending a right angle.

Ears triangular, undefined; margins concave. Posterior ear larger than the anterior. Anterior ear limited by an undefined sulcus and moderate sinus; extremity rounded. In the right valve, the anterior ear is narrow, acute, with a deep, angular byssal sinus.

Surface ornamented by prominent, rounded radii, which alternate irregularly with finer intercalated radii, and increase in size and number towards the margin; crossed by concentric striæ, with more distant varices of growth which crenulate the radii. The rays are stronger over the anterior slopes, and are continued on the ears, somewhat finer on the posterior and stronger on the anterior. In the right valve the strong rays are regularly duplicating, and are finer and equal on the posterior ear, with a few stronger ones on the anterior ear.

Ligamental area narrow.

Two left valves measure respectively 45 and 37 mm. in length, 42 and 44 mm. in height, hinge-line 40 and 30 mm. A right valve is 32 mm. in length, 27 mm. in height, hinge-line 28 mm. Other specimens of the left valve vary considerably, apparently according to age.

This species differs from *P. Vertumnus* in its greater proportional height, shorter hinge-line, abruptly rounded radii, and much sharper small intermediate striæ. The radii upon the right valve are also stronger and distinctly bifurcating; the concentric striæ are stronger, closer, and crenulate the rays more distinctly. *P. suborbicularis* is less oblique and the form more rounded, while the rays are more numerous and closely arranged.

Formation and localities. In the Chemung group at Belmont, Alleghany county, N. Y., and Mansfield, Tioga county, Pennsylvania.

PTERINOPECTEN ERECTUS.

PLATE LXXXII, FIGS. 15–17.

SHELL above medium size, transversely semi-elliptical, scarcely oblique; length and height nearly equal; pallial margins regularly rounded, slightly extended on the posterior side.

Valves moderately convex. Right valve apparently more convex than the left; the differences between them have not been satisfactorily determined.

Hinge-line straight, length a little greater than the length of the shell.

Beak small, acute, directed forward, little elevated above the hinge-margin; anterior to the middle of the shell. Umbonal region not defined.

Ears triangular, unequal. Posterior ear large, undefined; margin slightly concave; extremity acute. Anterior ear much smaller, not defined; margin concave; extremity acute. Byssal sinus shallow.

Surface marked by numerous rounded unequal radii; the larger ones alternating with one, two or three smaller ones; crossed by fine, sharp, regular, concentric striæ of growth. On the ears the striæ are fine and uniform.

Interior not known. Ligamental area narrow.

The largest specimen has a length of 32 mm., height 30 mm., hinge-line about 34 mm.

There is some resemblance between this species and *P. dispandus*, but it differs in its comparatively smaller size, longer hinge-line, and somewhat less oblique form.

Formation and locality. In the shales of the Chemung group at a point 600 feet above the base of the formation, at Ithaca, N. Y.

PTERINOPECTEN CRENICOSTATUS.

PLATE VIII, FIGS. 3, 4; AND PLATE LXXXII, FIG. 14.

Pterinopecten crenulatus (by error), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 8, figs. 3, 4. Jan., 1883.

SHELL large, sub-orbicular, slightly oblique; length somewhat greater than the height; pallial margins regularly curved, broadly rounded from the antero-lateral to the basal margin; post-lateral margin less convex.

Left valve very moderately convex. Right valve not known.

Hinge-line straight, length one-fifth less than the length of the shell, extended anteriorly, but not as far as the anterior margin of the valve.

Beak obtuse, rounded, scarcely directed forward, prominent, anterior to the middle. Umbonal region wide, indistinctly defined on the posterior side, more distinctly limited anteriorly, subtending an angle somewhat greater than 90°.

Ears triangular, flat. Posterior ear five times as large as the anterior, undefined; margin straight or slightly concave; extremity abruptly acute. Anterior ear small; margin deeply concave from the byssal sinus; defined by a distinct sulcus; extremity acute.

Test apparently thick, marked by about fifty strong, rounded rays which are simple or bifurcating, always with finer intermediate rays. Concentric striæ strong, elevated, conspicuously crenulating the radii. The radii mark the ears, and on the posterior ear are simple and distant.

Internal characters not known.

The two specimens figured give about the following respective dimensions: length 56, 57 mm., height 47, 53 mm., and length of hinge-line 52 and 46 mm.

This species differs from *P. suborbicularis* in being more inequilateral, with longer hinge, and stronger and less frequent radii. It differs from *P. Neptunus*, pl. 8, fig. 6, by its more erect form, extended hinge-line, distant and elevated radii, with stronger and more elevated concentric striæ.

Formation and localities. In the shales of the Chemung group at Angelica and Conewango, N. Y., and at Mansfield, Tioga county, Pa.

PTERINOPECTEN NEPTUNUS.

PLATE VIII, FIGS. 5-7.

Pterinopecten Neptunus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 8, figs. 5-7. Jan., 1883.

SHELL large, sub-orbicular, moderately oblique (more so in young shells); length one-fifth greater than the height; pallial margins regularly rounded, becoming extended posteriorly.

Valves moderately and nearly equally convex; very similar in form and surface markings.

Hinge-line straight, length less than the length of the shell, situated anteriorly as regards the body of the valve.

Beaks obtuse, rounded, directed slightly forward, nearly erect, not prominent. Umbonal region wide and undefined posteriorly, subtending a very obtuse angle.

Posterior ear much the larger, slightly concave on the margin; extremity angular. Anterior ear small, separated from the body of the shell by a sulcus; margin convex, extending obliquely outward from the byssal sinus; extremity acute.

Surface marked by closely arranged, rounded or sub-angular rays, which increase by intercalation and bifurcation. The ears are marked by simple and smaller rays, which in the right valve are distinctly angular. The rays become obsolete on the umbo. The concentric striæ are close, undulating, and in some conditions may have been sharply elevated and lamellose.

Internal characters not known.

The specimen, fig. 6 of pl. 8 is 55 mm. in length, 46 mm. in height, hinge-line 38 mm.

The comparison of this species with *P. crenicostatus* is given under the description of that species.

In surface ornamentation this species somewhat resembles *P. Vertumnus*, but the shell is shorter and less oblique, the hinge-line shorter, and the concentric striæ less elevated.

Formation and localities. In the shales of the Chemung group, Angelica and Philipsburg, Alleghany county, N. Y.

PTERINOPECTEN SUBORBICULARIS.

PLATE VIII, FIGS. 1, 2; PLATE XXIV, FIG. 10; AND PLATE LXXXII, FIG. 6.

Pterinea? suborbicularis, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 264. 1843.
Pterinopecten suborbicularis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 8, figs. 1, 2; pl. 24, fig. 10. Jan., 1883.

SHELL large, rhomboid-orbicular, slightly oblique; length a little greater than the height, or sometimes equal; pallial margins regularly curved, less convex on the posterior side; post-basal margin extended.

Left valve convex. Right valve nearly flat; similar in general form and surface markings.

Hinge-line straight, anterior, nearly equal to the length of the shell.

Beak obtuse, broad, rounded, somewhat depressed, directed slightly forward; a little anterior to the centre of the hinge. Umbonal region expanded, subtending an obtuse angle.

Ears triangular, unequal; extremities angular. Posterior ear the larger, undefined; margin concave. Anterior ear limited by an obscure sulcus. Byssal sinus shallow in the left valve, deep and angular in the right valve.

Surface marked by numerous regular, rounded or sub-angular radii, which increase on the left valve by intercalation, and on the right valve by bifurcation; interspaces nearly equalling the rays. On the posterior ear the rays are finer, and over the body of the shell they are strongly crenulated by lamellose concentric striæ.

Internal characters unknown. The ligamental area is a simple linear groove.

A large specimen measures 63 mm. in length, 55 mm. in height, the hinge-line 55 mm. Another one is 38 mm. in length, 35 mm. in height, with hinge-line 35 mm.

This species is distinguished by its sub-orbicular form, slight obliquity, nearly equal length and height, and comparatively short hinge-line.

The comparison with *P. crenicostatus* is given under the description of that species. It resembles the young of *Lyriopecten orbiculatus*, but the details of the characters are quite different.

Formation and localities. In the Chemung group at Hobbieville and Elm Valley, Alleghany county; New Albion, Cattaraugus county, N. Y., and Mansfield, Tioga county, Pennsylvania.

CRENIPECTEN,* Hall.

Crenipecten amplus.

PLATE IX, FIGS. 9, 13, 18.

Crenipecten amplus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 9, 13. Jan., 1883.
Crenipecten crenulatus? Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, fig. 18. Jan., 1883.

Shell larger than medium, broadly and obliquely ovate; height about one-sixth greater than the length; margins regularly rounded, more extended posteriorly.

Left valve very convex. Right valve not known.

Hinge-line straight, about equal to one-half the length of the shell, situated a little anterior to the middle.

Beak obtuse, erect, prominent. Umbonal region very convex, well defined, subtending a right angle.

Ears nearly equal; margins gently concave. Posterior ear somewhat the larger, defined by a sulcus. Anterior ear defined by a sulcus which is more distinct and abrupt. Byssal sinus shallow.

Surface of the cast marked by fine, irregular, concentric striæ, with obsolescent, fine radiating lines. Ligamental area narrow and distinctly crenulate.

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* The forms here described under this generic term have in part been referred to Pernopecten by Professor Winchell; but a critical study of the type species of that genus shows that it possesses a large central cartilage-pit with a crenulated hinge-plate on each side below the hinge-margin, which characters alone are sufficient to distinguish the genus and exclude the forms here described under Crenipecten. See discussion of the relations of Pernopecten, Entolium and Crenipecten, in the introduction to this volume.

The largest specimen is 33 mm. in length, 38 mm. in height, hinge-line 16 mm.

This species differs from *P. crenulatus* in its proportionally greater height, rotundity, and less obliquity.

Although known only as a cast, it is distinctively different from other species.

Formation and locality. In shales of the Chemung group at Rockville, Alleghany county, N. Y.

CRENIPECTEN CRENULATUS.

PLATE IX, FIGS. 6, 7, 8, 15, 16, 17.

Pecten? crenulatus, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 265. 1843.
Crenipecten crenulatus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 6–8, 15–17. Jan., 1883.

SHELL of medium size, ovoid-orbicular, moderately oblique; length and height nearly equal; margins regularly rounded, somewhat extended posteriorly.

Right valve convex. Left valve depressed-convex above, and nearly flat below.

Hinge-line straight, length more than one-half the length of the valve, anterior to the middle of the shell.

Beaks obtuse, central, inclined somewhat forward, not rising above the hinge-line. Umbonal region of the right valve prominent, subtending an angle of about 100°.

Ears small, triangular, subequal, limited on the right valve by the rapid slope of the sides of the umbo; margins slightly concave; extremities angular. Byssal sinus not defined.

Test thin; conspicuously marked with fine, concentric striæ of growth, and obscure or nearly obsolete radii (as seen in figs. 7, 8 and 16, pl. 9). The concentric lines are stronger on the ears, and are sometimes cancellated by fine rays.

Ligamental area narrow, crenulated by a row of minute cartilage-pits.

A medium-sized specimen has a length of 29 mm., height 31 mm., hinge-line 17 mm. A smaller specimen has a length of 26 mm., height 29 mm., and hinge-line 16 mm.

All the specimens are in the condition of casts or much exfoliated, and the surface markings are therefore obscure.

The species was originally founded upon specimens of the left valve; the right valves shown in figs. 6, 7 and 8, pl. 9, occur in the same association, and have been identified as of the same species.

This species differs from *C. obsoletus* in its proportionally greater convexity and length, and the obliquity of the transverse axis. It is also longer than *C. amplus.*

Formation and locality. In shales of the Chemung group at Rockville, Alleghany county, N. Y.

CRENIPECTEN IMPOLITUS.

PLATE IX, FIG. 14; AND PLATE LXXXIII, FIG. 10.

Crenipecten impolitus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, fig. 14. Jan., 1883.

SHELL of medium size, obliquely sub-ovate; length somewhat less than the height; anterior and basal margins regularly rounded, produced behind and extending thence in nearly a direct line to the beak.

Left valve depressed-convex. Right valve not known.

Hinge-line straight, anterior, less than half the length of the shell.

Beak obtuse, rounded, low, inclined a little forward. Umbonal region scarcely defined, subtending about a right angle.

Ears nearly equal; margins concave. The posterior ear extends along the posterior margin as a narrow expansion. In well-preserved specimens the ears are defined by sulci. Byssal sinus inconspicuous.

Obscure evidences of concentric striæ appear in the casts.

Internal characters unknown.

Two specimens have respectively the following dimensions: length 24 and 16 mm., width 26, and 19 mm., hinge-line 9 and 7 mm.

In general form and convexity this species resembles *C. crenulatus,* but it is narrower above, with the hinge-line comparatively much shorter.

The specimens are casts of the interior preserved in coarse sandstone; the surface markings are consequently obliterated.

Formation and locality. In a coarse sandstone of the Chemung group near Olean, Alleghany county, N. Y.

CRENIPECTEN OBSOLETUS.

PLATE IX, FIGS. 19, 21.

Lima? obsoleta, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 265. 1843
Crenipecten obsoletus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 19, 21. Jan., 1883.

SHELL small, obliquely sub-ovate, length nearly equal to the height; margins regularly curved, becoming produced on the post-basal side, and somewhat rectilinear on the posterior side.

Valves very similar. Right valve depressed-convex. Left valve regularly convex.

Hinge-line straight, a little more than one-half the length of the shell.

Beak obtuse, more prominent on the left valve; situated in the centre of the hinge. Umbonal region well defined in the left valve; depressed and undefined in the right valve.

Ears small, triangular, sub-equal, defined by shallow sulci; margins gently concave; extremities obtuse. Posterior ear a little the larger. Byssal sinus not conspicuous.

Test thin, marked by fine, closely arranged, concentric striæ, which are crowded and stronger on the ears. No radiating striæ have been discovered.

Ligamental area narrow, marked by a row of minute cartilage-pits.

A left valve measures 18 mm. in length, 20 mm. in height, hinge-line 10 mm. A similar right valve is 16 mm. in length, 17 mm. in height, hinge-line 8.5 mm.

This species bears some resemblance to *C. crenulatus*, but is more elongate-ovate; less oblique, with the height somewhat greater than length.

Formation and locality. In shales of the Chemung group at Philipsburg, Alleghany county, N. Y.

CRENIPECTEN GLABER.

PLATE IX, FIGS. 20, 22?

Lima glaber, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 255. 1843.
Crenipecten glaber, HALL. Pal. N. Y, vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 20, 22? Jan., 1883.

SHELL small, ovate, erect, very slightly oblique; height about one-fifth greater than the length; pallial margins regularly rounded, more extended on the posterior side.

Left valve moderately convex above, and depressed-convex below. Right valve unknown.

Hinge-line straight, length equal to about one-half the length of the valve.

Beak acute, erect, somewhat prominent, not elevated above the hinge. Umbonal region well defined by the sulci, subtending an acute angle.

Ears triangular, nearly equal, separated from the body of the shell by shallow sulci; margins straight or slightly concave: posterior ear a little the larger. Byssal sinus not distinct.

The cast is marked only by fine concentric striæ.

Interior unknown.

The crenulations of the ligamental area are obscure in the specimen.

The original of this species is 12 mm. in length, 16 mm. in height, and hinge-line 6 mm.

This specimen is embedded vertically to the lines of rock bedding, and the proportions of length and height may have been changed. The species is known by its erect form, conspicuous ears and great comparative height.

The specimen of figure 22 is referred with doubt to this species; the erect form is similar; the proportional length is slightly greater.

Formation and localities. In shales of the Chemung group at Philipsburg and Rockville, Alleghany county, N. Y.

CRENIPECTEN MICROPTERUS.

PLATE IX, FIG. 23.

Crenipecten micropterus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 2, 3. Jan., 1883.

SHELL small, longitudinally and obliquely sub-elliptical; length somewhat greater than the height; margins regularly rounded, produced behind and extending in nearly a direct line to the beak.

Right valve depressed-convex. Left valve unknown.

Hinge-line short, straight, anterior; length about one-third the height of the valve.

Beak low, obtuse. Umbonal region not strongly defined, subtending an obtuse angle.

Ears very small, nearly equal, bounded by shallow sulci. Byssal sinus not distinct.

Surface marked by numerous low, rounded radii, with wider interspaces and smaller intermediate radii; crossed by fine concentric lines of growth, which are stronger and crowded on the ears, forming their only surface marking.

Interior unknown. Ligamental area obscurely crenulate.

The specimen described has a length of 18 mm., width 16 mm., hinge-line 5 mm.

This species resembles in form *C. crenulatus*, but differs in the radii, and in the proportionally much shorter hinge-line. The surface markings are similar to *C. liratus*, but it is different in its proportions of length and height.

Formation and locality. In the shales of the Chemung group at Philipsburg, Allěghany county, N. Y.

CRENIPECTEN LIRATUS.

PLATE IX, FIG. 24; AND PLATE LXXXIII, FIG. 9.

Crenipecten liratus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, fig. 24. Jan., 1883.

SHELL small, obliquely sub-ovate; length a little less than the height; anterior and basal margins rounded; post-basal margin produced, and thence extending in a direct line to the beak.

Left valve moderately convex, the greatest convexity distant one-third the height of the valve from the beak. Right valve unknown.

Hinge-line straight, short, length about one-third the height of the valve.

Beak acute, erect, a little anterior to the centre of the shell, not rising above the hinge. Umbonal region moderately elevated, subtending an acute angle.

Ears small, triangular, defined by moderate sulci; the posterior ear the larger. Byssal sinus not distinct.

Surface marked by prominent, rounded, alternating radii, with intermediate smaller ones. There are about six larger rays, six smaller, and twice that number of still smaller intermediate striæ, all crossed by strong, regular, concentric laminæ of growth. The ears are apparently destitute of rays.

The crenulations of the ligamental area are small and obscure.

The specimen figured has a length of 20 mm., height 22 mm., hinge-line 7 mm.

This species somewhat resembles *C. micropterus* in the radii, but differs in all other characters.

Formation and locality. Chemung group at East Randolph, Cattaraugus county, N. Y.

CRENIPECTEN LEON.

PLATE IX, FIG. 12; AND PLATE LXXXIII, FIG. 8.

Crenipecten Leon, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, fig. 12. Jan., 1883.

SHELL of medium size, ovate, slightly oblique; length about one-sixth less than the height; margins regularly curved, produced below, rather straight on the upper part of the posterior side.

Left valve moderately convex; the greatest convexity is a little below the middle.

Hinge-line straight, short, nearly central; length about one-third the height of the valve.

Beak acute, erect. Umbonal region not strongly marked, subtending an acute angle.

Ears sub-equal, small, sulci not conspicuous; posterior ear the larger. A narrow rim, slightly elevated and free from rays, extends from the posterior ear along the margin of the shell.

Surface marked with numerous distinct, rounded or sub-angular rays, and wider interspaces with smaller intermediate rays; with fine concentric striæ and undulations at irregular intervals. The rays are stronger over the posterior half of the valve.

Ligamental area linear, and crenulated with narrow cartilage-pits.

The specimen figured has a length of 26 mm., height 30 mm., hinge-line 10 mm.

This species differs from all the others in its form and surface characters.

Formation and locality. In sandstone of the Chemung group at Leon, Cattaraugus county, N. Y.

CRENIPECTEN WINCHELLI.

PLATE IX, FIGS. 1, 2, 4, 25–30.

Aviculopecten Winchelli, MEEK. Pal. of Ohio, vol. ii, p. 296, pl. 15, figs. 50, 56. 1875.
Crenipecten (*Pecten*) *Winchelli* (MEEK), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 9, figs. 1, 2, 4, 25–30. Jan., 1883.

SHELL larger than medium, flabelliform, equilateral, not oblique; length a little greater than the height; margins regularly rounded below. On the anterior side, from a point two-thirds the height of the valve above the base, the antero-cardinal margin extends in a direct line to the beak; the posterior side, from a point a little above the middle, also slopes in a direct line to the beak.

Left valve moderately convex; the greatest convexity about one-third the height of the shell from the beak. Right valve nearly flat, depressed-convex above. The right and left valves are unlike.

Hinge-line straight, central, length about two-thirds the length of the shell. In several specimens referred to the right valve, the length of the hinge is nearly equal to the length of the valve.

Beak of left valve acute, erect, prominent. Beak of right valve depressed, obtuse, not rising above the hinge-line. Umbonal region of left valve distinctly defined, subtending a right angle.

Ears of left valve triangular, defined by shallow but distinct sulci. Margin of anterior ear convex, with a shallow sinus at the base. Posterior ear the larger; margin concave, with a comparatively broad sinus. The extremities of the ears in the right valve are acute. Byssal sinus deeper and more angular in the right valve.

Surface of left valve marked by numerous rounded or sub-angular, alternating rays, with somewhat wider interspaces, crossed by sharp, elevated, concentric striæ; the ears show the same markings. Right valve marked by obscure radii, which are stronger on the ears.

Ligamental area with numerous narrow cartilage-pits.

A large left valve has a length of 47 mm., height 42 mm., hinge-line 29 mm. Another individual measures 27 mm. in length, 26 mm. in height, hinge-line 18 mm. A right valve referred to this species has a length of 20 mm. and a height of 18 mm., hinge-line 17 mm.

This species differs from any known form of Crenipecten; it is like Aviculopecten in external form and surface characters, and resembles the recent genus Pecten.

Mr. Meek compares this species with *Aviculopecten Coxanus*, Meek and Worthen, from the coal measures of Illinois and Nebraska. It is evident that the crenulations of the hinge have not been previously observed. Except in the hinge crenulations, this form has no other relations with the genus Crenipecten, and it may be found to belong to some genus yet undescribed, which will include other species now placed with the Carboniferous forms of Aviculopecten.

In the original description of the genus, McCoy has not indicated the intimate structure of the hinge, and it is not improbable that there are several generic types among the species included in the Carboniferous forms of Aviculopecten.

The right and left valves have not been found in connection, but their association, and the absence of similar forms in the same beds, render the identity nearly certain.

Formation and locality. In the Waverly sandstone near Newark, Ohio.

PTERINEA, Goldfuss.

Pterinea grandis, n. sp.

PLATE LXXXIII, FIG. 14.

Shell very large, capacious, oblique, sub-rhomboidal, body broadly ovate; length about one-fifth greater than the height; margins regularly rounded, broad along the base, and a little produced on the posterior side.

Left valve convex. Right valve unknown.

Hinge-line straight, apparently somewhat less than the length of the valve, [imperfect in the specimen.]

Beak obtuse, prominent, directed forward. Umbonal region gibbous, subtending an angle of about 90°.

Wing large, triangular, not distinctly defined, margin rounded, with a gentle concavity near the junction of the valve. Ear not observed.

Test thick, marked by distant, strong radii from the umbo to the base; the interspaces having alternating larger and smaller rays; crossed by concentric, undulating lamellose striæ of growth.

Interior unknown.

The specimen has a length of 120 mm., height 100 mm., and the hinge-line, from the beak to the extremity of the wing, 95 mm.

This species is distinguished by its large size, very distant strong radii, and convexity. Compared with *P. flabella*, it is proportionally longer, and the wing less defined. Compared with *P. pinguis*, it differs in greater length and somewhat less gibbosity.

Formation and locality. In the upper Helderberg limestone, in Scott Co., Indiana.

PTERINEA PINGUIS.

PLATE XV, FIGS. 2, 3; AND PLATE LXXXIII, FIG. 13.

Pterinea pinguis, HALL. Pal. N. Y, vol. v, pt. 1. Plates and Explanations: Pl. 15, figs. 2, 3. Jan., 1883.

SHELL large; gibbous, obliquely ovate, length and height nearly equal. Pallial margins rounded, produced on the posterior basal side, and concave at the junction of the wings.

Left valve ventricose, sub-angular along the anterior side. Right valve unknown.

Hinge-line straight, nearly central; length somewhat greater than the length of the shell.

Beak acute, angular, arching over the hinge, situated near the anterior extremity of the hinge-line, directed forwards. Umbonal region prominent, ventricose, defined, subtending an acute angle.

Wing large, triangular, limited by the rapid post-cardinal slope of the valve; margin slightly concave, rounding to the extremity which is angular. The extent of the ear is not known, but it is limited by a deep sulcus which gives an angular aspect to the antero-cardinal slope of the shell. Byssal sinus not marked in the specimens.

Surface ornamented with about fifteen broad, strong, rounded rays, crossed by lamellæ of growth. The specimens described are weathered casts of the interior and preserve only slight evidence of the surface characters.

Interior not known.

The largest specimen has a convexity of about 20 mm., its length 70 mm., height 65 mm., hinge-line more than 65 mm. Another example has a convexity of about 20 mm., length 63 mm., height 74 mm., hinge-line 55 mm.

This species bears some general resemblance to *P. flabella*; it differs in its large ventricose form, more elevated umbo, the characteristics of the upper part of the anterior side of the body, and the abrupt slope into the wing without a distinct sulcus.

Formation and locality. In the Corniferous limestone, near Columbus, Ohio.

PTERINEA FLABELLA.

PLATE XIV, FIGS. 1-21; PLATE XV, FIGS. 1, 4-6, 8-10; AND PLATE LXXXIII, FIGS. 11, 12.

Avicula flabella, CONRAD. Jour. Acad. Nat. Sci., Phil., vol. 8, p. 238, pl. 12, fig. 8. 1842.
" " (") VANUXEM. Geol. Surv. N. Y.: Report Third Dist. 1843.
Compare *Pterinea fasciculata*, GOLDFUSS. Petrefacta Germaniæ, p. 137, pl. 120, fig. 5. 1840.
" " " (") Sandberger, Verstein, Rhein, Schichtensyst, Nassau, p. 293, pl. 30, fig. 7. 1856.
" " *costulata*, F. A. ROEMER, DUNKER and VON MEYER. Palæontographica, T. 1, fig. 2.
Pterinea flabella, (CONRAD) HALL. Pal. N. Y., vol v, pt. 1. Plates and Explanations: Pl. 14, figs. 1-21; pl. 15, figs. 1, 4-6, 8-10. Jan., 1883.

SHELL large; broad or narrow ovate, oblique, rarely erect; length from two-thirds to nearly equal the height; and in some extravagant forms the height is about double the length; the greatest length below the middle; anterior and basal margins regularly curved; the posterior margin from a little above the base, follows a nearly straight line to the beak.

Left valve more or less convex, often gibbous and arcuate. Right valve flat or concave, with a little convexity on the umbo; arcuate, to correspond with the curvature of the opposite valve.

Hinge-line straight, extended upon the posterior side; length greater than the length of the valve.

Beak of left valve acute, rounded, situated near the anterior extremity of the hinge, curving forwards over the hinge margin. In rare instances the beak does not extend quite as far as the margin of the hinge. Umbo of the left valve prominent, gibbous, limited by the sulci of the cardinal expansions, and subtending an angle of from 30° to 60°. Beak of the right valve depressed, rounded, not rising above the hinge; umbonal region depressed-convex, gradually merging into the body of the valve, which is concave below.

Wing large, triangular, nearly flat, varying in proportions, defined (in the left valve) by the post-cardinal slope; margin concave; extremity acute, rounded. Ear of left valve a simple rounded convex lobe or auriculation, defined by a distinct, broad, rounded sulcus; margin rounded above, sinuate at its junction with the valve, forming the byssal sinus. The cardinal expansions of the right valve are similar in dimensions to those of the opposite valve; nearly in the same plane with the body of the shell, and defined only by the surface striæ and the sinus.

Test strong, nacreous, often having a thickness of more than one millimetre. Left valve marked with from six to ten or twelve strong rounded rays, which originate at or near the beak and continue simple to the margin. The interspaces are marked by smaller, alternating costæ, increasing by interstitial addition as the shell increases in size. The surface is also ornamented with strong, elevated, concentric lamellose striæ of growth, which are more or less distinctly bent backwards over the stronger radii. The cardinal expansions are marked with rays; those on the ear in well-preserved specimens, are stronger than on the wing.

In the partially exfoliated condition, and in the casts, the ears show the concentric striæ; and the wings show evidences of the rays. In some conditions the rays are nodose from the concentric laminæ, and in older examples there are undulations of growth which interrupt the rays and increase their nodose aspect.

In the right valve the surface is marked with concentric lines which are more crowded on the cardinal expansions, and with a few strong radii on the wing, which are sometimes quite obsolete.

The casts of the interior sometimes show traces of the stronger radii; but usually they are not preserved.

In the various phases of maceration and exfoliation, the specimens present gradation from the finer radii to the stronger ones, and some specimens are quite destitute of surface markings. They vary also in the number of stronger radii, the development of the wing, the comparative length and width of the body, the arcuation of the valves, the prominence of the beaks, and the thickness of the test. In rare examples, the stronger rays below the umbo are broken up and merged with the finer striæ.

The pallial line originates in a small, deep, anterior muscular impression just beneath the anterior tooth, and extends nearly parallel with the margin of the valve almost two-thirds the distance from the beak to the base of the shell, where it is abruptly recurved, terminating in a large, ovate, posterior muscular impression directly below the posterior extremities of the lateral teeth.

Ligamental area marked by a variable number of sharp narrow grooves, which extend to the extremities of the hinge-line, and probably correspond to the successive laminæ of growth.

In the left valve, there are four or five linear, diverging cardinal teeth, beneath and anterior to the beak; in the right valve only two or three such teeth are seen. Two or three linear, slightly diverging, lateral teeth, are situated below the ligamental area, and posterior to the umbo.

A young symmetrical specimen has a length and height (without the ear) of 15 mm.; and the greatest extent from the beak to the post-basal margin is 21 mm. A medium sized specimen is 36 mm. in vertical height; extreme distance from beak to base 47 mm.; length parallel to hinge-line 35 mm., and hinge-line from beak to extremity of wing 38 mm. Another is 46 mm. in vertical height; extreme distance from beak to base 52 mm.; length parallel to hinge-line 46 mm., and hinge-line from beak to extremity of posterior wing 56 mm. A specimen of different proportions is 52 mm. in vertical height; extreme distance from beak to post-basal margin 63 mm.; length parallel to hinge-line 40 mm.; hinge-line from beak to extremity of posterior wing 40 mm.

This species in surface ornamentation differs greatly from every other form below the Carboniferous period, and possesses true pterinoid characters in a stronger degree than any other species from the New York rocks. The right valve when detached is not so easily distinguished from some other forms, as *Pterinea Chemungensis* and *Actinoptera Boydi.*

The species is co-extensive with the Hamilton group throughout the State of New York. An apparently abnormal form, in its unusually large wing, (Pl. XV., fig. 6,) found in the Chemung group, has been referred to this species; and specimens of similar character are common in certain localities.

The specimens occurring in the Chemung group are much larger, and of more extravagant growth, than any yet observed in the Hamilton group. A large specimen has a height of 100 mm.; another measures 90 mm. in length, and is of equal extent along the hinge-line. The costæ on these large forms are often only four in number and very strong and broad. (See plate lxxxiii, fig. 11.)

Formations and localities. This species has been recognized in a single ill-preserved specimen from the Corniferous limestone, at Stafford, Genesee county, N. Y.; casts of the interior, and a single extravagant form preserving the surface characters, have been obtained from limestone of the same age near Columbus, Ohio. It is abundant in the Hamilton group at numerous localities from Schoharie to Cayuga lake, more rarely in the western part of the State; though occurring at Hamburg and elsewhere on Lake Erie shore. It is found in the upper beds of the Chemung group in Steuben county, N. Y., and Tioga county, Pennsylvania.

PTERINEA INTERSTRIALIS, n. sp.

PLATE LXXXIV, FIG 22.

SHELL large; left valve obliquely ovate, narrow above; length and height nearly equal; anterior and basal margins regularly curved; posterior margin produced.

Left valve moderately convex, depressed towards base. Right valve unknown.

Hinge-line straight, about equal to the length of the shell.

Beak acute, inclined forward. Umbonal region not prominent, narrow, limited by the cardinal expansions; subtending an acute angle.

Wing triangular, large; margin concave; extremity acute. Ear triangular, small.

Surface marked by about 20 regular, strong, rounded rays which originate on the upper part of the umbo and continue undivided to the margin; with broad, flat interspaces marked by from two to four slender, sharp radii, and crossed by fine concentric striæ. About twelve of the strong rays reach the margin of the valve below the middle of its height, the remainder come out on the upper anterior margin. The wing shows the radii somewhat less strong than the body of the valve. The ear is marked by strong radii.

Interior unknown.

The specimen described has a greatest length of about 55 mm.; height nearly 58 mm.; hinge-line from beak to extremity of wing, about 58 mm.

This species somewhat resembles *P. flabella;* and differs in its less convexity, more numerous strong rays with finer intermediate lines, and less conspicuous concentric striæ.

Formation and locality. In sandstone of the Chemung group at Chemung Narrows, Chemung county, N. Y.

PTERINEA DISPANDA.

PLATE XV, FIG. 7.

Pterinea dispanda, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 15, fig. 7. Jan., 1883.

SHELL large; body very broadly ovate, nearly erect; length greater than the height; anterior margin very convex; basal margin flattened, not produced posteriorly.

Left valve regularly convex, and only moderately gibbous on the umbo. Right valve unknown.

Hinge-line straight, greater than the length of the body, extended posteriorly beyond the margin of the valve.

Beak anterior, nearly rectangular, prominent, directed forward. Umbonal region ample.

Ear small, separated from the body of the shell by a broad undefined sulcus, which is marked by several oblique folds. Byssal sinus deep and abrupt. Wing very large, depressed-convex, broad-triangular; defined by the retral curving of the concentric striæ; concave on the margin; extremity extremely produced and acute.

Test ornamented with strong, unequal, rounded radii, which are sometimes bifurcating on the anterior portion. The wing is marked with similar smaller rays which are sometimes fasciculate. Entire surface also marked by concentric lamellose striæ, which at irregular intervals are crowded into fascicles, giving an undulating aspect to the surface, and a low nodose appearance to the stronger rays.

Interior unknown.

The specimen described has a height of 70 mm., length about 80 mm., and the length of the hinge-line about 90 mm.

This shell bears some resemblance to the more extravagant forms of *Pterinea flabella*, but it is larger than any known specimen of that species, with a proportionally longer and less defined body, and distinctly different surface ornamentation.

Formation and locality. In the upper beds of the Chemung group at Mansfield, Tioga county, Penna.

PTERINEA CHEMUNGENSIS.

PLATE XVI, FIGS. 3, 7, 10, 12; PLATE LXXXIV, FIG. 21.

Avicula Chemungensis, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. 8, p. 243. 1842.
Avicula pecteniformis, HALL. Geolog. Surv. N. Y.: Rept. Fourth Dist., p. 262. 1843.
Pterinea Chemungensis, (CONRAD) HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 16, figs. 3, 7, 10, 12. Jan., 1883.

SHELL very large, rhomboidal; body of shell ovate, narrower above, nearly erect, or sometimes oblique; length less than the height; greatest length below the middle; basal and post-basal margins rounded; the anterior margin above the middle is nearly straight, and the corresponding portion of the posterior margin is gently concave.

Left valve moderately convex above, depressed-convex in the lower part. Right valve depressed-convex towards the beak, flat or slightly concave below.

Hinge-line straight, central; length nearly or quite equal to the length of the shell.

Beak anterior, acute, directed forward, arching a little over the hinge-line. Umbonal region not strongly defined, most prominent a little below the hinge; subtending an acute angle.

Ear short, nearly equilateral, limited by a rounded sulcus; margin concave, with a marked sinuosity and arching of the shell for the byssal sinus. Wing large, triangular, and extending beyond the posterior margin of the valve, not distinctly defined by a sulcus or by marked change in the surface characters from the body of the shell; margin straight or slightly concave; extremity obtuse. In the right valve, the wing is less distinctly defined than in the left.

Test somewhat thin; left valve marked by slender, filiform rays, variously alternating and bifurcating, or sometimes simple from the umbo to the base, continuing over the wing, and somewhat stronger on the anterior cardinal extremity than on the posterior; the interspaces flat, much wider than the rays. The surface is crossed by fine, closely arranged, concentric striæ, which are occasionally crowded, giving an unequal elevation to the rays. These are also often interrupted and undulated, either from accident to the shell or intermittent growth, and are sometimes nearly obsolete at the base. The right valve is marked by the same interrupted rays on the wing; on the body of the shell the radii are obsolete, but the concentric striæ are preserved. The specimens are generally found as casts, or in an extremely macerated condition.

Ligamental area wide, marked by fine, narrow grooves the whole length of the hinge. Obscure indications of lateral teeth have been seen.

A left valve is 62 mm. in length, 76 mm. in height, hinge-line 55 mm. Another one has a length of 55 mm., height and hinge-line each 62 mm. A very large specimen is 85 mm. in height, 102 mm. from beak to post-basal margin, length 70 mm., hinge-line about 65 mm. A right valve has a length of 55 mm., height 60 mm., hinge-line about 60 mm.

The form varies from nearly erect to considerably oblique, and is usually characterized by the broadly rounded base and interrupted rays, which are coarse and fine, and irregularly arranged.

This species resembles *P. rigida,* but the radii have an appearance of less rigidity, the hinge-area is narrower and the shell is more oblique. It is closely allied to *P. consimilis,* differing in the proportionally shorter hinge-line, greater height of body, and less obliquity.

Formation and locality. In the Chemung group at Chemung Narrows, Chemung county, N. Y.

PTERINEA CONSIMILIS.

PLATE XVI, FIGS. 1, 2, 8, 9, 11; AND PLATE LXXXIV, FIG. 23.

Pterinea consimilis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 15, figs. 1, 2, 8, 9, 11. Jan., 1883.

SHELL large, sub-rhomboidal, nearly orbicular; length greater than the height; margins regularly curved, moderately produced on the posterior end.

Left valve convex above, depressed-convex below. Right valve convex on the umbo, flat or slightly concave below.

Hinge-line straight, length equal to or a little greater than the length of the valve.

Beak acute, anterior, inclined slightly forward, not rising above the hinge. Umbonal region prominent but not strongly limited, subtending more than a right angle.

Ear small, limited by the abrupt slope of the umbo, which becomes a distinct sulcus in the right valve; margin convex (except in the byssal sinus); extremity rounded. Byssal sinus not distinct. Wing broad, triangular, undefined, much extended; margin concave; extremity acute.

Surface of left valve marked by numerous flattened, slender, filiform rays, with broad, flat interspaces, which are marked by one or two, more or less distinct, finer rays. The radii are often undulating, and become obscure towards the base. The cardinal expansions are correspondingly marked. Fine, closely arranged, inconspicuous concentric striæ cross the surface. The wings of both valves are similar in surface characters. The body of the right valve shows the concentric striæ, with obscure indications of rays.

Ligamental area broad, marked by fine parallel grooves the entire length. Lateral teeth two, strong, converging. Cardinal teeth preserved as three short plications under the beak of the left valve. Pallial line simple, originating anterior to the beak, continuing nearly parallel to the margin of the valve, recurving and terminating in a large muscular scar on the post-cardinal slope adjacent to the wing.

A left valve has a length of 52 mm., height 49 mm., hinge-line about 50 mm. A right valve has a length of 46 mm., height 40 mm., hinge-line 48 mm.

This species differs from *P. Chemungensis* in being shorter, proportionally more extended on the hinge-line, with wider ligamental area, more distinct radii, and greatly different proportions of length and breadth, as shown in the right valves.

Formation and localities. In the Chemung group at Buck's quarry and Chemung, Chemung county, and Smithboro, Tioga county, N. Y.

PTERINEA RIGIDA.

PLATE, XVI, FIGS. 5, 6.

Pterinea rigida, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 16, figs. 5, 6. Jan., 1883.

SHELL of medium size, sub-rhomboidal, erect; body ovate, narrow above; length somewhat less than the height; margins regularly rounded, slightly extended on the post-basal portion and straight along the posterior side.

Left valve moderately convex above, depressed-convex below. Right valve unknown.

Hinge-line straight; length about equal to the length of the valve.

Beak acute, prominent, directed forward, rising to the hinge-margin. Umbonal region elevated, subtending an acute angle.

Ear small, limited by the moderate byssal sinus and broad sulcus. Wing large, broad-triangular, undefined; margin slightly concave; extremity angular.

Surface marked with about thirty slender, rigid, rounded rays, which are sometimes flat or grooved along the summit, continuous from the upper part of the umbo; with wider flat interspaces which sometimes show a fine intermediate ray coming in below the umbo. The cardinal expansions are marked by rays of the same character. Lines of growth cross the surface.

Interior unknown.

A medium sized specimen has a length of 31 mm., height 34 mm., hinge-line about 35 mm. A smaller specimen is 26 mm. in length, 25 mm. in height, hinge-line 24 mm.

This species bears a general resemblance to *P. Chemungensis;* it differs in its continuous and comparatively stronger rigid radii. The group of four species, beginning with *P. Chemungensis*, is well marked and have many characters in common; but nevertheless, present differences which warrant their specific separation.

Formation and localities. In the Chemung group, at several localities in Chemung county, N. Y.

Pterinea prora.

PLATE XVI, FIGS. 4, 13, 14.

Pterinea prora, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 16, figs. 4, 13, 14. Jan., 1883.

Shell of medium size or larger, sub-rhomboidal, oblique; body ovate, narrow above; length one-fourth greater than the height; margins regularly rounded, extended on the post-basal portion and sloping rapidly into the sinus of the wing.

Left valve moderately convex. Right valve depressed-convex above, flat or concave below, apparently smaller than the left.

Hinge-line straight, longer than the length of the valve, and extending beyond both margins.

Beak small, acute, directed forward, situated at about the anterior fifth of the hinge. Umbonal region undefined, not prominent.

Ear about one-fifth the length of the wing, separated from the body of the valve by a shallow undefined sulcus and marked byssal sinus; margin convex; extremity rounded. Wing large, triangular, extended, defined only by the change in the curvature of its margin from that of the body of the valve; margin deeply concave; extremity acute.

Surface of left valve marked with regular, rounded, sub-equal rays, with flat interspaces which are sometimes marked by intermediate rays; crossed by fine, concentric lines of growth. The cardinal expansions of both valves show the same character of radii as the body of the left valve. The right valve has subdued rays in the lower posterior portion; the upper part shows only the concentric markings in regular lamellæ of growth.

Interior unknown.

One specimen is 34 mm. in length, 28 mm. in height, hinge-line 44 mm. Another is 38 mm. in length, 32 mm. in height, hinge-line about 47 mm.

This species has a resemblance to the left valve of *P. avis;* but the left valve of the present species has greater convexity, more extended hinge-line, and a broad, deep sinuosity in the margin of the wing.

The large right valve represented in fig. 4, of plate xvi, is referred with doubt to this species on account of its greater size. This specimen shows a large, broad, elliptical muscular impression near the middle of the post-cardinal slope of the valve.

Formation and localities. In the Chemung group at Buck's quarry near Elmira, and Chemung Upper Narrows, Chemung county, N. Y.

The three following species have the right valves convex, and the left valve nearly flat or concave, being the reverse, in this respect, of the preceding species of the group. The hinge-area is narrow and teeth have not been observed, while the surface markings are peculiar and characteristic in the three forms here described. For these reasons I have considered it desirable to distinguish them, for the present, under a sub-generic head.

VERTUMNIA, n. s. g.

PTERINEA (VERTUMNIA) REVERSA.

PLATE XXIV, FIGS. 6, 12; AND PLATE LXXXIV, FIG. 24.

Pterinea reversa, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, figs. 6, 12. Jan., 1883.

SHELL large, rhomboid-orbicular; body somewhat oblique; length and height nearly equal; margins regularly rounded, a little more extended on the posterior side.

Left valve flat, or slightly concave, except near the umbo. Right valve moderately convex, the greatest convexity about the middle of the height.

Hinge-line straight, length equal to the length of the valve, extending anteriorly beyond the margin.

Beak of left valve depressed, obtuse, undefined, erect. Beak of right valve low, obtuse, inclined forward. Umbo not distinct in either valve.

Ear of the right valve limited by a distinct broad byssal sinus. Wing triangular, undefined.

Surface marked by strong, rounded, simple, continuous radii which originate upon the umbo; with wide, flat interspaces, which, in the right valve, show occasionally a finer ray; crossed by regularly arranged, sharp, concentric striæ, which are conspicuous both on the rays and interspaces. The rays are obscure and distant on the upper part of the cardinal expansions.

A large right valve has a length of 50 mm., height 47 mm., hinge-line 55 mm.

This species differs from *P. prora* by its lesser obliquity, the indefiniteness of the cardinal expansions, the convexity of the right valve, and the flat or concave character of the left valve.

Formation and locality. In the Chemung group near Elmira, at the Upper Narrows of Chemung river, N. Y., and in Tioga county, Pa.

PTERINEA (VERTUMNIA) AVIS.

PLATE XXIV, FIGS. 9, 11, 13.

Pterinea reversa, var. avis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, figs. 9, 11, 13. Jan., 1883.

SHELL of medium to large size, rhomboidal, oblique; body ovate; length greater than the height; margin moderately rounded in front, becoming full on the posterior side.

Left valve depressed-convex above, flat or concave below. Right valve convex; the greatest convexity about the middle of the valve.

Hinge-line straight, length greater than the length of the shell, extended anteriorly beyond the margin of the valve.

Beak low, obtuse, inclined forward, situated on the anterior third of the hinge-line.

Cardinal expansions unequal, triangular, flat; margins concave; extremities mucronate. Ear limited by a broad, shallow sulcus extending from the beak to the rounded byssal sinus. Wing large, undefined.

Surface of both valves marked by about twenty-five strong, rounded, equal rays, reaching from the umbo to the base, with broad, flat interspaces which occasionally show a single fine intermediate ray. The same surface characters extend over both cardinal expansions. The entire surface is marked by fine, regular, sharp, continuous, concentric striæ.

Internal characters unknown.

A left valve, illustrated on plate xxiv, fig. 13, has a length of 44 mm., height 31 mm., hinge-line 49 mm. A large right valve has a height of 45 mm., length 65 mm., and hinge-line about 65 mm.

This species resembles *P. reversa,* but differs in its comparatively greater obliquity, more extended hinge, and proportionally greater length. It differs from *P. prora* in the flatness of the left valve, the strong rays, the sharp elevated striæ, and the convexity of the right valve.

Formation and locality. In the Chemung group at Buck's quarry, near Elmira, Chemung county, N. Y.

PTERINEA (VERTUMNIA) REPROBA, n. sp.

PLATE LXXXII, FIGS. 19, 20.

SHELL of medium size, rhomboidal; body oblique; length somewhat greater than the height; pallial margin regularly rounded, becoming produced behind and extending thence in a nearly direct line to the hinge.

Valves depressed-convex, the right valve the more convex; very similar in form and surface markings.

Hinge-line straight, length greater than the greatest length of the shell, extended anteriorly considerably beyond the margin of the valve.

Beaks obtuse, not prominent, directed forward, anterior to the middle. Umbonal region undefined.

Ear defined by a shallow sulcus; margin concave; extremity acute. Byssal sinus moderate, marked in the right valve by a partial reflexion of the margin. Wing large, triangular and undefined; margin nearly straight below, slightly concave toward the extremity, which is acute.

Surface marked by numerous strong, rounded rays, which alternate on the left valve, and duplicate on the right valve. The interspaces are equal to, or greater than, the radii; the rays are finer on the cardinal expansions, and very obscure on the ear and umbonal region of the right valve. Concentric striæ regular, sharp.

Interior not known.

Ligamental area narrow, and marked by one or two longitudinal furrows. The sharp striæ in their extension over the hinge-margin give the exterior a crenulated appearance.

A left valve has a length of 25 mm., height 22 mm., hinge-line 30 mm. A right valve has a length of 36 mm., height 28 mm., hinge-line 37 mm.

This species differs from *Pterinopecten Vertumnus* by its comparatively longer hinge-line, more extended ear, less distinctly curving, narrower, and more abruptly elevated radii on the left valve; and stronger, not undulating, duplicating radii of the right valve. The form and proportions are similar to

Pterinopecten lœtus, but it is a larger and coarser form, with the right valve convex. The geological positions of the two species are quite different. The character of the surface ornamentation distinguishes it from *Pterinea prora* and *Pterinea avis*.

Formation and locality. In shales of the Chemung group, 600 feet above the base of the formation, at Ithaca, N. Y.

ACTINOPTERIA, Hall.

Actinopteria eximia.

PLATE XXV, FIG. 1.

Actinopteria eximia, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, fig. 1. Jan., 1883.

Shell small, rhomboidal; body falciform, very oblique; length more than one-third greater than the height; margin broadly curved along the ventral side and abruptly recurved over the posterior end.

Left valve convex. Right valve unknown.

Hinge-line straight, less than the length of the valve.

Beak acute, directed forward. Umbonal angle about 60°.

Ear short, oblique, limited by a distinct sulcus; margin convex; extremity rounded. Wing imperfectly preserved in the specimen described, apparently joining the body near the middle of the post-cardinal slope, and very strongly defined; margin concave, extending acutely backwards; extremity acute.

Test marked by about twenty strong, elevated slender rays, with regular lamellæ of growth which are extended and bent backwards on crossing the rays, producing strong semi-tubular spines. The cardinal expansions preserve only the lines of growth.

Interior unknown.

The specimen described has a length of 20 mm., and height of 14 mm.

The description is made from the figure given on plate xxv, as the specimen cannot be found at the time of this writing. The characters of form and surface ornamentation are very characteristic, and the species is important as being the only one of the genus yet found in the Schoharie grit. It differs from *A. muricata* in its narrower and more oblique body and shorter wing, as measured along the post-cardinal slope.

Formation and locality. In the Schoharie grit, at Schoharie, N. Y.

ACTINOPTERIA MURICATA.

PLATE XVII, FIGS. 1-3.

Avicula muricata, HALL. Geol. Surv. N. Y.: Rep. Fourth Dist., p. 181. 1843.
Pteronites muricatus, HALL. Cat. Am. Pal. Foss.: S. A. Miller, p. 202. 1877.
Actinopteria muricata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, figs. 1-3. Jan., 1883.

SHELL small, sub-rhomboidal; body sub-ovate, very oblique; length one-third greater than the height; margin rounded below, turning abruptly backward on the posterior side, and extending in a direct line to the beak.

Left valve convex. Right valve unknown.

Hinge-line straight from the beak to the posterior extremity, sloping downward on the anterior side; entire length greater than that of the body of the shell.

Beak acute, arching over the hinge, inclined forward, situated at the anterior third of the hinge-line. Umbonal region subtending an acute angle.

Ear broad-triangular, separated from the body of the shell by a broad undefined sulcus which is limited by a strong sub-angular fold extending from the beak, and by the deep rounded byssal sinus; margin convex; extremity obtuse. Wing flat, triangular, defined by having more subdued surface rays; margin deeply sinuate; extremity mucronate.

Test thin, marked with from eight to twelve strong, filiform rays, with finer intermediate ones in the broad, flat interspaces. The rays on the wing are somewhat subdued. Surface crossed by fine concentric lines of growth, which, at intervals, are crowded and raised into lamellæ, and on the rays are produced into tubular spines. These spines are seen only in the better preserved specimens, and appear in the casts as elongate elevations upon the rays. The concentric striæ are conspicuous in the anterior sulcus.

Interior unknown.

Ligamental area grooved.

The largest specimen has an entire length of 16 mm., height 10 mm., hinge-line, to the imperfect posterior extremity, 12 mm. A smaller specimen has an entire length of 14 mm., height 9 mm., hinge-line 15 mm. The smallest specimen measures 10 mm. in length of body and hinge-line, and 6 mm. in height.

In form and surface characters this species is quite unlike any other described from these rocks. In some respects it resembles *A. eximia*, fig. 1, pl. xxv; but has more extended wing and less elongate body.

Formation and locality. In the Marcellus shale at Littleville near West Avon, Livingston county, N. Y.

ACTINOPTERIA DORIS, n. sp.

PLATE XVII, FIG. 4.

Actinopteria Leander, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, fig. 4. Jan., 1883.

SHELL small, sub-rhomboidal; body obliquely sub-ovate; length a little greater than the height; margins regularly rounded, sloping abruptly from the upper part of the posterior side to the beak.

Left valve depressed-convex. Right valve unknown.

Hinge-line straight, about equal to the length of the shell (imperfect in the specimen described).

Beak depressed, inclined forward, situated at the anterior third of the hinge. Umbonal region not defined, subtending an acute angle.

Ear not observed. Wing large, flat, not distinctly defined; margin concave; extremity acute.

Test thin, marked by regular, equal, rounded radii, with wider flat interspaces, and sometimes with obscure intermediate rays. The wing shows finer rays, somewhat crowded at its junction with the body. The fine, concentric lines of growth are stronger on the anterior of the valve, giving a cancellate aspect to the surface.

Interior unknown.

Ligamental area with one or two longitudinal grooves.

The specimen has a length of 18 mm., height 16 mm.

Formation and locality. In the Marcellus shale at East Bloomfield, Ontario county, N. Y.

ACTINOPTERIA SUBDECUSSATA.

PLATE XVII, FIGS. 23, 25-27, 29-31; AND PLATE XIX, FIG. 25.

Pteronites subdecussata, HALL. MS., vol. v. 1877.
" " " S. A. Miller in Cat. Am. Pal. Foss., p. 202. 1877.
Actinopteria subdecussata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, figs. 23, 25-27, 29-31; pl. 19, fig. 25. Jan., 1883.

SHELL large, sub-rhomboidal, very oblique; body elongate sub-ovate; height about one-third less than the length; margins regularly curved, becoming more extended on the posterior side.

The left valve, in old specimens, has the umbo convex above, depressed-convex or flat below, while in young specimens the umbo is altogether convex or gibbous. Right valve moderately convex near the umbo, flat or concave below the middle.

Hinge-line straight, length about one-fifth less than the length of the shell, not extending as far as the posterior margin of the left valve, but extending beyond the posterior margin of the right valve.

Beak acute, directed forward, somewhat prominent, anterior nearly terminal. Umbonal region (in young shells) well marked by the sulci; umbonal angle acute.

Ear very small, separated by a vertical sulcus. Wing large, triangular, defined in young shells by the abrupt convexity of the post-cardinal slope; in old specimens not distinctly defined; margin concave; extremity acute. The wing of the right valve is larger, and extends beyond the margin of the shell.

Test comparatively thin, marked with regular, sub-angular, alternating radii, the stronger ones extending from the summit of the umbo; a second set intercalated on the lower part of the umbo, and a third set of smaller rays coming in toward the margin. The first and second series only are shown in young shells. In the right valve the radii are more subdued. The rays extend over the cardinal expansions of both valves in nearly uniform size. Concentric, elevated, regularly rounded striæ of growth cross the rays, and cancellate the surface, and at intervals are crowded together, giving it a lamellose aspect.

Interior unknown.

Ligamental area marked by one or two parallel grooves.

A large specimen has a length of 65 mm., height 47 mm., hinge-line 55 mm. A specimen of medium size has a length of 51 mm., height 35 mm., hinge-line 41 mm. A smaller example has a length of 18 mm., height 11 mm., hinge-line 13 mm.

This species is similar in form to *A. decussata*, but differs in the convexity of the valves and the less strongly decussated character of the ornamentation, the rays being continuous and annulated by the concentric striæ, while in that species the rays are interrupted by strong concentric lamellæ, between which are the finer lines of growth.

This species is also less abundant and more restricted in geographical range.

Formation and localities. In the shales of the Hamilton group on the shores of Canandaigua lake, and near Bellona, Yates county, N. Y.

ACTINOPTERIA DECUSSATA.

PLATE XVII, FIGS. 24, 28; PLATE XVIII, FIGS. 1-15; PLATE XX, FIG. 19; AND PLATE LXXXIV, FIG. 4.

Avicula decussata, HALL. Geol. Surv. N. Y.: Rep. Fourth Dist., p. 203. 1843.
Pteronites decussata, HALL. S. A. Miller, Cat. Am. Pal. Foss., p 202. 1877.
Actinopteria decussata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, figs. 24, 28; pl. 18, figs. 1-15. Jan., 1883.

SHELL large, sub-rhomboidal; body sub-ovate, very oblique; length about one-fourth greater than the height; margins regularly curving; the anterior margin sometimes nearly vertical; posterior margin more abruptly rounded.

Valves convex; the right valve less convex and smaller than the left valve.

Hinge-line straight, less than the length of the valve.

Beak acute, prominent, inclined forward, close to the anterior end of the shell. Umbonal region prominent, and in the left valve gibbous; subtending an acute angle.

Ear small, separated from the valve by a broad sulcus, beyond which it is a mere fold in the shell. Wing large, triangular, flat, extending nearly to the margin of the valve; limited, in the left valve, by a more or less distinct sulcus, and the abrupt bending of the concentric striæ; margin concave; extremity acute. This character of the wing is somewhat less marked in the right valve.

Test thick; the left valve marked with strong, prominent, rounded radii, regularly alternating with finer ones on the posterior half of the valve; crossed at regular intervals by strong concentric lamellæ; the interspaces marked by fine lines of growth. From maceration or exfoliation these surface characters are usually only partially preserved, or nearly obsolete. In certain conditions the rays become nodose where crossed by the lamellæ, and in many examples the concentric striæ interrupt the rays, leaving them alternating above and below the lamellæ. (See pl. xviii, figs. 13, 14.) The surface characters of the body are continued on the wing, while on the ear the concentric striæ are crowded and conspicuous, and the rays obsolete. In the right valve the markings are much subdued, the rays often obsolete, especially on the lower part of the valve, and the concentric lamellæ are simple undulations of the surface.

Ligamental area narrow, linear; marked, apparently, by a single groove. The cast shows a fold corresponding to the sulcus limiting the wing. Pallial line extending from just anterior and below the umbo to the posterior portion of the body and thence recurving, terminating in a small oval muscular impression. No evidences of teeth are seen in the casts or the interior of valves.

A large specimen has a length of 76 mm., height 56 mm., hinge-line 62 mm. A medium sized example has a length of 52 mm., height 43 mm., hinge-line 42 mm.

This form differs from *A. subdecussata* in the greater and nearly equal convexity of the valves, the stronger, rounded rays, and their interruption by the concentric lamellæ.

Formation and localities. In the Hamilton group, at numerous places in Central and Western New York.

ACTINOPTERIA BOYDI.

PLATE XIX, FIGS. 2-24, 26-30; AND PLATE LXXXIV, FIGS. 16, 17.

Avicula Boydii, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 237, pl. 12, fig. 4. 1842.
Pterinea Boydi, CONRAD. S. A. Miller in Cat. Am. Pal. Foss., p. 201. 1877.
Avicula quadrula, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 243, pl. 13, fig. 5. 1842.
Actinopteria Boydi, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 19, figs. 2-24, 26-30; pl. 23, figs. 5, 6. Jan., 1883.
Compare *Avicula perobliqua,* CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 235, pl. 12, fig. 1. 1842.
" " *pleuroptera,* CONRAD. " " " " " p. 242, pl. 13, fig. 2. 1842.

SHELL of medium size, rhomboidal; body ovate, varying in proportions, the longitudinal axis at an angle with the hinge-line of from 45° to 60°; length varying from nearly equal to one-fourth greater than the height; margins regularly rounded below, straight and nearly vertical for a short distance in front; post-basal side extended.

Valves convex, the right valve a little less convex than the left.

Hinge-line straight from the anterior side of the beak to the posterior extremity.

Beak anterior, acute, prominent, inclined forward, rising above the hinge in the left valve. Umbonal region prominent, subtending an acute angle.

Ear short, oblique, limited by a deep but not sharply defined sulcus. Wing large, triangular, not distinctly separated from the body of the shell; margin concave; extremity acute. In the right valve the ear is somewhat more extended, the sulcus not strong, but the byssal sinus is marked; the wing is proportionally larger and usually more acute at the extremity.

Test thick; the left valve, in well-preserved specimens, is marked by numerous strong, simple, sharp rays, which are continuous from the umbo to the margin, with rarely intercalated finer rays; crossed by regular, sharp, elevated, concentric lamellæ which (in good specimens) are produced into subtubular, spiniform extensions upon the rays. Lines of growth are seen between the lamellæ. On the wing the rays are more subdued while the concentric lamellæ are strong. The ear is marked only by the crowded concentric striæ. On the right valve the radii are obsolete on the body and well-marked on the wing, and the lamellose expansions are conspicuous. In some casts they appear as undulating elevated lamellæ.

Pallial line extending parallel to the margin of the shell and terminating in a muscular impression on the posterior slope. A small muscular impression is also seen just in front of the beak, and obscure indications of one or two cardinal teeth.

Ligamental area narrow, striated, marked by two or three slender grooves, which are slightly divergent from the hinge-line.

One of the original specimens of *A. quadrula* (=*A. Boydi*) has a length of 30 mm., height and hinge-line each 28 mm. A similar specimen has a length of 25 mm., height and hinge-line each 23 mm.

Two large specimens belonging to the group of *A. Boydi* have the following respective dimensions: length 38, and 40 mm., height 38, and 35 mm., hinge-line 34, and 30 mm.

This species, in older specimens, resembles *A. subdecussata*, but differs in the character of the rays, in the less obliquity, and the wider body. The left valve somewhat resembles the right valve of *Avicula recticulata*, Hisinger, but a comparison of the right valves of both species shows them to be different.

The forms here classed under one specific designation were described by Mr. Conrad under different species, viz.: *Avicula Boydii*, *A. quadrula*, *A. pleuroptera*, and probably *A. perobliqua*.

The species in its various stages of growth and state of preservation presents a great variation in form and surface characters. The usual condition is that of casts of the interior or specimens more or less exfoliated, leaving the surface markings subdued or obsolescent, and in a few specimens only, have the entire characters of the test in either or both valves been observed. The older specimens show an extension of the shell along the post-basal margin which is marked by concentric striæ and undulations, while the rays become interrupted and obsolete.

After a study and comparison of a very large number of individuals, it has not been found possible to draw any satisfactory line of specific distinction. The figures on plate xix illustrate all the important varieties of form that have been observed.

The specimens illustrated in figures 2, 3, 4 of plate xix, represent the typical form of *A. quadrula*, Conrad; the figures 9, 10, 11 of the same plate more nearly correspond to the *A. Boydii*, Conrad. All the right valves show the same degree of convexity and the same surface characters, and vary in form no more than the variations in the left valve. The extreme forms seen in figures 26 and 27 are old shells, showing the irregular growth of the margins, leaving the upper portions of the shell of normal form and surface characters.

The following are Mr. Conrad's descriptions:

" Avicula *Boydii*, pl. 12, fig. 4.—Sub-rhomboidal, compressed, lower valve " with numerous radii, disposed to be interrupted by concentric lines, which " are fimbriated, or have numerous angular indentations; anterior wing short, " sinuous, truncated; posterior wing ample; posterior extremity of the valves " acutely rounded."

" Avicula *quadrula*, pl. 13, fig. 5.—Sub-quadrate; length and width equal, " compressed; lower valve plano-convex, with distant radii of equal size, " crossed by concentric lines; posterior wing rather shorter than the width of " the shell; anterior wing triangular, beneath which the margin is direct before " rounding to the beak."

The unrecognized form is indicated as follows:

" Avicula *pleuroptera*, pl. 13, fig. 2.—Lower valve sub-ovate, ventricose, with " obsolete radii; summit of umbo above the cardinal line; anterior wing very " short; the posterior wing produced, rostrated, acute, with an oblique rib or " carina on the posterior half, extending to the acutely angulated extremity." The *oblique rib or carina* mentioned was probably one of the lateral teeth as shown in figure 12, plate xix.

The Avicula angustirostra of Conrad, cited as occurring at Middleville, Schoharie county, is probably from the Hamilton shales at Fultonham; and the only species from this locality, answering the description given, is *A. Boydii*, in a condition in which the radii and elevated concentric lamellæ are more conspicuous than in any specimens from Cazenovia, Hamilton, or any other locality in Central New York.

Formation and localities. In the shales of the Hamilton group; abundant at numerous places in the eastern and central portions of the State.

ACTINOPTERIA PEROBLIQUA.

PLATE XIX, FIG. 31; PLATE LXXXIV, FIG. 14.

Avicula perobliqua, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 235, pl. 12, fig. 1. 1842.
Actinopteria perobliqua, (CONRAD) HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 19, fig. 31. Jan., 1883.

SHELL of medium size, sub-rhomboidal; body very oblique, narrow-ovate; length one-third greater than the height; anterior margin truncate or slightly concave; basal margin regularly arched and acutely rounded over the post-basal side.

Valves very convex. Left valve gibbous in the upper part, angular along the post-cardinal slope. Right valve somewhat less convex.

Hinge-line straight, about two-thirds the length of the shell.

Beak anterior, acute, prominent, inclined forward. Umbonal region gibbous, subtending an acute angle.

Ear a small lobe, defined by a distinct sulcus and shallow, elongate, byssal sinus. Wing large, triangular, limited by the angular post-cardinal slope of the valves; margin moderately concave, sloping forward; extremity angular.

Test (as seen in the specimen, which is a partial cast of the interior), marked by irregular concentric striæ, which become fasciculate on the wing; the surface apparently without rays.

Muscular impression large, sub-quadrangular below the middle of the post-cardinal slope, from which, the pallial line curving downward below the middle of the valve, extends parallel with the margin to the anterior side of the umbo.

The specimen described has a length of 37 mm., height 24 mm., hinge-line 27 mm.

This specimen occurs associated with *A. Boydi* and other allied forms, and is known by the convexity of the valves, the sub-angular character of the posterior slope of the left valve, the great obliquity, the proportions of length and height, and the absence of radii in the cast.

Mr. Conrad's original description of *A. perobliqua* is as follows:

" Avicula *perobliqua*, pl. 12, fig. 1.—Obliquely sub-ovate, with radiating lines " distinct only on the posterior side; dorsal line rectilinear, long and very " oblique; anterior wing short, wide, sinuous, the front margin inclining to a " regular arch; posterior extremity acutely rounded.

" *Locality*—Hamilton, Madison county, N. Y.; Upper Silurian shale.

" A common species, very easily distinguished from others of the genera " with which it is associated, by its long, very obliquely ovate outline. Casts " of the interior scarcely exhibit any radiation. It is often found with connected " valves."

The radii mentioned in this description cannot be recognized in the specimen which preserves only concentric striæ on some parts of the surface. Mr. Conrad's description may have included casts of *A. Boydi*, which show slight traces of radiation, and occur in the same association.

Formation and locality. In the shales of the Hamilton group, Cazenovia, Madison county, N. Y.

ACTINOPTERIA PUSILLA, n. sp.

PLATE LXXXIV, FIG. 3.

SHELL small, sub-rhomboidal; body ovate, very oblique; length and height nearly equal; margin for a short distance on the anterior side nearly vertical, broadly rounded along the base and produced on the posterior side.

Right valve convex on the umbo, becoming depressed below the middle of the length. Left valve unknown.

Hinge-line straight, less than the length of the shell.

Beak anterior, acute, moderately prominent. Umbonal region scarcely gibbous, subtending an acute angle.

Wing narrow, triangular, elongate, extending nearly to the posterior end of the shell; margin concave; extremity abruptly acute.

Test thin, marked by elevated, sub-imbricating concentric bands, produced by the lamellose character of the striæ. Crossing these bands, on the posterior half of the shell, are interrupted radiating lines, which indicate the presence of radii upon the original surface. The wing is marked in a similar manner by strong bands, which pass over the hinge-margin, and it also shows two or three interrupted radiating lines, like those on the posterior part of the body of the shell.

Interior unknown.

The specimen described has a length of 11 mm., height 12 mm., and hinge-line 10 mm.

This species is allied to *A. decussata* and *A. Boydi*, having the wing characteristic of the former; but it is a proportionally shorter form, and the surface markings are quite unlike the right valve of any of the forms at present known.

Formation and locality. In shales of the Hamilton group, on the shores of Canandaigua lake, N. Y.

ACTINOPTERIA PERSTRIALIS.

PLATE XXIII, FIGS. 2, 7; AND PLATE LXXXIV, FIG. 12.

Actinopteria perstrialis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 2, 7. Jan., 1883.

SHELL small, sub-rhomboidal; body sub-ovate, axis slightly curved and oblique at an angle of about 45° with the hinge; height about three-fourths the length of the body; basal margin broadly rounded; posterior margin abruptly curved.

Left valve regularly convex, moderately gibbous at the umbo. Right valve depressed-convex below, more convex above.

Hinge-line straight, length equal to the length of the body.

Beaks sub-anterior, in the left valve prominent and rising above the hinge; in the right valve the beak extends to the hinge-line. Umbonal region moderately gibbous in the left valve, convex in the right, subtending nearly a right angle.

Ear short, separated from the body by a marked byssal depression; extremity rounded. Wing narrow, triangular, joining the body midway between the beak and the posterior extremity, not distinctly defined; margin concave; extremity produced and acute. The right valve is less distinctly auriculate in front; the anterior extremity acute; the wing is larger and the margin less abruptly concave.

Test thin, marked by fine concentric striæ which are more conspicuous and equidistant on the right valve. The left valve is marked with fine, closely-arranged radii, which are strongest on the upper margin of the wing. The body of the right valve shows only sharp, distant, concentric striæ; the wing is marked by a few rays in the lower part, and by stronger radii along the hinge-line, which are cancellated by the concentric striæ. The auricle is radiated, and cancellated in the same manner.

Interior unknown.

A left valve has a length of 13 mm., height 10 mm., and hinge-line 12 mm. A large right valve has a length of 15 mm., height 12 mm., and hinge-line 15 mm.

This species differs from *A. tenuistriata* in its more oblique body, comparatively longer hinge-line, and more closely arranged and stronger radii.

Formation and locality. In the lower part of the Chemung group, near Ithaca, N. Y.

ACTINOPTERIA TENUISTRIATA, n. sp.

PLATE LXXXIV, FIGS. 5, 6.

SHELL small, sub-quadrate; body short-ovate, oblique at an angle of 60° with the hinge; length about one-fifth greater than the height; anterior margin below the sinus nearly vertical, and then making a broad curve along the base; posterior margin broadly curved.

Left valve regularly convex below the middle, gibbous on the umbo. Right valve smaller, nearly equally convex.

Hinge-line straight, a little greater than the height of the valve.

Beaks at about the anterior third of the hinge-line, prominent, obtuse, rising above the hinge. Umbonal region gibbous and ample, subtending nearly a right angle.

Ear small, defined by a distinct sinus and byssal depression, rounded at the extremity. Wing small, triangular, joining the body below the middle of its length, not strongly limited; margin gently concave; extremity acute.

Test thin, marked by fine concentric striæ, and filiform radiations with wider interspaces, which are marked by extremely slender intermediate striæ. On the anterior side the radiating lines are finer, and on the cardinal margin of the wing they are stronger. The right valve is marked only by elevated concentric striæ, and the wing by fine radiations, which become stronger toward the cardinal margin.

One specimen has a length of 16 mm., height 13 mm., and hinge-line 14 mm.

This species is distinguished from *A. perstrialis* by its erect and more nearly quadrate form, shorter ear, less extended wing with less concave margin, and more distant, finer striæ.

Formation and locality. In the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA AURICULATA, n. sp.

PLATE LXXXIV, FIG. 15.

SHELL small, rhomboidal; body ovate, oblique at an angle of more than 45° with the hinge; length about one-fifth greater than the height; anterior margin rounded to the sinus; base gently curved; posterior margin abruptly recurved.

Left valve regularly convex below, gibbous above. Right valve unknown.

Hinge-line straight, greater than the height of the valve.

Beak anterior to the middle of the hinge-line, acute, prominent, arching over the hinge. Umbonal region abruptly gibbous, subtending an acute angle.

Ear large, straight above, limited by an abrupt vertical byssal depression; extremity rounded. Wing small, not strongly defined, joining the body two-thirds of its length below the beak; margin concave; extremity produced.

Test marked by concentric striæ, and about twenty somewhat strong, sharp radii; this ornamentation is also continued on the wing and the ear.

Interior unknown.

The specimen is 10 mm. in length, 6 mm. in height, hinge-line 7 mm.

This species resembles *A. perstrialis* in form, but differs in the larger ear, abrupt vertical byssal depression, shorter wing and coarser radii.

Formation and locality. In the Chemung group at Lawrenceville, Tioga county, Pa.

ACTINOPTERIA DELTA.

PLATE XXIII, FIG. 3.

Actinopteria delta, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, fig. 3. Jan., 1883.

SHELL of medium size, rhomboidal; body broad-ovate, oblique at an angle of about 60°; height less than three-fifths the length; anterior margin rounded, curving into a defined sinus; base broadly curved; post-basal side abruptly rounded.

Left valve gibbous above, gently convex below. Right valve unknown.

Hinge-line straight, about equal to the height of the valve.

Beak at about the anterior third of the hinge, directed forward, prominent, rising above the cardinal line. Umbonal region gibbous, nearly rectangular.

Ear rounded, defined by a distinct byssal depression which extends forward from the beak. Wing small, joining the body near the posterior extremity, not strongly defined; margin gently concave; extremity produced.

Test marked by fine concentric striæ, and undulating or interrupted filiform radiations, with wider interspaces, which have probably been marked by finer intermediate striæ. The concentric lines are obscure in the cast and appear as a few irregular concentric undulations.

Interior unknown.

The specimen is 23 mm. in length, 15 mm. in height, hinge-line 16 mm.

Formation and locality. In the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA EPSILON.

PLATE XXIII, FIGS. 4, 8, (5 and 6?).

Actinopteria epsilon, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 4, 8. Jan., 1883.

SHELL of medium size, rhomboidal; body ovate, oblique to the axis at an angle of about 60°; height about three-fourths the length; anterior margin rounded into a very abrupt sinus; base broadly curved; post-basal side abruptly rounded.

Left valve moderately convex. Right valve depressed-convex above, flat or concave below.

Hinge-line straight, length somewhat less than the height of the valve.

Beaks anterior, acute in the left valve; prominent and elevated above the hinge. Umbonal region gibbous, subtending an angle of less than 60°.

Ear short, defined by a deep, abrupt byssal depression. Wing triangular, joining the body below the middle, not strongly defined; margin regularly concave; extremity acute and produced.

Test thin, in the left valve marked by somewhat distant, elevated, lamellose, concentric striæ, with intermediate finer lines, and by abruptly elevated rounded rays with wider interspaces; these are cancellated by the concentric striæ, which are more conspicuous on the wing. In the right valve the radiating striæ are subdued, and the concentric striæ become more conspicuous.

Interior unknown.

A specimen of the left valve is 21 mm. in length, 16 mm. in height, and hinge-line 14 mm.

This species differs from *A. delta* by its narrower form and greater obliquity of body.

Formation and locality. In the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA ZETA.

PLATE XXIII, FIG. 9; AND PLATE LXXXIV, FIGS. 1, 2.

Actinopteria zeta, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, fig 9. Jan., 1883.

SHELL large, rhomboid-orbicular; body broadly ovate, nearly erect; height greater than the length; auricular margin rounded into the byssal sinus; below the sinus the margin is nearly vertical and gradually joining the broad basal curvature; posterior end regularly rounded.

Left valve gently convex below, moderately gibbous above. Right valve flat or concave below, depressed-convex above.

Hinge-line straight, much longer than the greatest length of the valve.

Beak in the left valve sub-anterior, elevated, curving over the hinge; in the right valve depressed, not rising above the hinge-line. Umbonal region subtending nearly a right angle.

Ear small, rounded at the extremity, defined by a strongly marked byssal depression. Wing large, joining the body below the middle, not strongly defined; margin deeply concave in the middle; extremity produced into an acute extension.

Surface marked by strong, elevated, regular, distant, lamelliform, concentric striæ, with intermediate finer lines, and by slender, filiform, undulating, distant rays, which are more crowded on the anterior side, becoming finer and more numerous at the junction of the wing with the body, and a few much stronger ones along the cardinal line. Rays not present on the ear, which is marked only by the crowded concentric striæ. The concentric striæ crenulate the rays and bend backward in the interspaces, producing a beautifully cancellated surface.

The right valve shows two oblique lateral folds or teeth posterior to the beak.

A right valve has a length of 25 mm. parallel to the hinge, height 28 mm., hinge-line about 34 mm. An imperfect left valve has an approximate length of 22 mm., height 24 mm., and hinge-line 33 mm.

This species is distinguished by its erect, orbicular form, great extension of hinge-line, and marked surface characters.

Formation and locality. In the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA ETA, n. sp.

PLATE LXXXIV, FIGS. 8-11.

SHELL of medium size, rhomboidal; body broad and short-ovate, oblique at an angle of about 45°; length about one-fourth greater than the height; anterior margin below the sinus nearly vertical, curving gradually into the broad base; posterior side regularly rounded.

Left valve regularly convex below, moderately gibbous above. Right valve smaller, depressed-convex below, gently convex above.

Hinge-line straight, length greater than the height of the shell.

Beak in the left valve sub-anterior, prominent, arching over the hinge; in the right valve subdued, scarcely rising above the hinge-line. Umbonal region gibbous in the left valve, subtending an acute angle.

Ear, in the left valve rounded at the extremity, slightly oblique, defined by a distinct byssal depression. In the right valve the ear is larger and flat, strongly limited. Wing comparatively large, extending three-fourths the length of the valve, not strongly defined; margin concave; extremity produced and acute. In the right valve the wing is larger, extending almost as far as the posterior side of the valve.

Surface of left valve marked by distant, lamellose, concentric striæ, and by radiations with wider interspaces, which have sometimes slender intercalated rays. The concentric lamellæ crenulate the radii, and are arched backward in the interspaces, producing a beautifully cancellated surface. The finer concentric striæ between the lamellæ are rarely visible, and the spaces between the rays show, under a lens and in well-preserved examples, extremely fine, crowded radiations. The radii are also seen in the depression limiting the ear, and on the wing they are equal to those on the body of the valve. The right valve is marked by regular, equidistant, concentric lamellæ. The posterior slope and wing show numerous fine radii which are crossed by concentric striæ continued from the lamellæ on the body of the valve.

Interior unknown.

A small specimen is 20 mm. long, 14 mm. high, and hinge-line 16 mm. A larger imperfect example has, approximately, a length of 30 mm., height 22 mm., and hinge-line 24 mm.

In surface characters this species resembles *A. zeta*, but is distinguished by its greater obliquity and much smaller wing.

Formation and locality. In the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA THETA, n. sp.

PLATE LXXXIV, FIGS. 18, 19.

SHELL large, sub-rhomboidal; body broadly ovate, oblique at an angle of about 55°; length about one-fourth greater than the height; anterior margin, below the ear, nearly vertical, curving into the broad base; posterior end regularly rounded.

Left valve moderately convex, depressed below. Right valve smaller and less convex, nearly flat below.

Hinge-line straight, length nearly equal to the height of the shell.

Beaks sub-anterior, prominent, arching over the hinge-line in the left valve. Umbonal region moderately gibbous in the left valve, subtending an acute angle.

Ear rounded, a little oblique, defined by a nearly vertical depression. In the right valve the ear is flat or concave, limited by the abrupt elevation of the umbo. Wings large, in the left valve extending about three-fourths the length of the body, and in the right valve joining the body at the posterior end, without distinct limitation in either valve; margin moderately concave; extremity slightly produced, angular.

Surface of left valve marked by sharp, elevated, lamellose, concentric striæ, with intermediate finer lines; and by slender, elevated rays, with wider interspaces between the primary rays, which are often occupied with one or two finer lines; the ear and wing are marked in a similar manner. The rays are distinctly crenulated, and the interspaces are cancellated by the concentric lines, which are slightly curved backward. The surface of the right valve is marked by strong, lamellose, concentric striæ, which become less conspicuous on the wing. The posterior slope of the body and the wing of this valve are marked by numerous fine rays.

Interior unknown.

A specimen, with the two valves attached, has approximately a length of 48 mm., height 30 mm., and hinge-line 33 mm.

This species resembles *A. eta*, but differs in the more extended wing, finer radii of the left valve, with interstitial additions, narrower interspaces, and more numerous concentric lamellæ.

Formation and locality. In the shales of the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA IOTA, n. sp.

PLATE LXXXIV, FIG. 7.

SHELL of medium size, rhomboidal; body broadly ovate, oblique at an angle of about 45°; length about one-seventh greater than the height; anterior margin nearly vertical or slightly inclined for a short distance, thence curving into the broad base; posterior end broadly rounded.

Left valve depressed below, regularly convex above, scarcely gibbous. Right valve unknown.

Hinge-line straight, about equal to the length of the shell.

Beak sub-anterior, prominent. Umbo moderately gibbous, subtending an acute angle.

Ear comparatively short, defined by a distinct byssal depression, rounded at the extremity. Wing not strongly limited, extending quite as far as the posterior extremity of the shell; margin somewhat deeply concave in the middle; extremity produced and acute.

Surface marked by concentric lamellose striæ, and fine thread-like rays, which are crenulated and cancellated by the lines of growth both on the body and on the wing.

Interior unknown.

One of the specimens is 30 mm. in length, 22 mm. in height, and hinge-line about 30 mm.

This form resembles *A. theta*, but the body is proportionally shorter, the hinge-line longer, the wing margin more concave and the extremity more produced.

Formation and locality. In the lower part of the Chemung group at Ithaca, N. Y.

ACTINOPTERIA KAPPA, n. sp.

PLATE LXXXIV, FIG. 13.

SHELL of medium size, rhomboidal; body narrowly ovate, oblique at an angle of less than 45°; length one-third greater than the height; anterior margin oblique, rounded into the broadly curved basal margin; posterior end abruptly rounded.

Left valve depressed below, convex from the middle upward. Right valve unknown.

Hinge-line straight, equal to the height of the valve.

Beak sub-anterior, prominent, arching over the hinge-line. Umbonal region moderately gibbous.

Ear short, oblique, rounded anteriorly, defined by a distinct byssal depression. Wing triangular, joining the body nearly two-thirds of the length from the beak; margin oblique, concave; extremity produced, acute.

Test thin, marked by fine, concentric, irregularly fasciculating striæ, giving an undulated appearance to the surface, and by filiform, interrupted and undulating radii, with wider interspaces, which sometimes show fine intercalated rays. The radii upon the wing are prominent and cancellated by the concentric striæ, and are obsolete upon the ear.

Interior unknown.

The specimen has a length of 30 mm., height 20 mm., and hinge-line 20 mm.

This species differs from *A. epsilon*, in the greater obliquity, longer hinge-line, and more distant radii.

Formation and locality. In the lower member of the Chemung group at Ithaca, N. Y.

PTYCHOPTERIA, Hall.

Ptychopteria Proto.

PLATE XXIII, FIGS. 12, 14.

Ptychopteria Proto, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 12, 14. Jan., 1883.

Shell small, rhomboidal; body narrow-ovate, oblique at an angle of about 35° with the hinge-line; length more than one-third greater than the height; ante-byssal margin sub-truncate, rounding into the broad sinus; base broadly rounded; posterior end somewhat abruptly curved.

Left valve regularly convex below, gibbous in the middle and above. Right valve unknown.

Hinge-line straight, length a little greater than the height of the valve, and nearly equal to two-thirds its length.

Beak at about the anterior third of the hinge, prominent, inclined forward. Umbo abruptly gibbous, subtending an acute angle.

Anterior end large,* rounded, limited by a broad byssal depression directed backward; extremity angular. Wing small, narrow-triangular, extending to near the posterior end of the body; margin scarcely concave; extremity obtuse.

Surface marked by fine, regular, elevated radii, which are less conspicuous on the wing; also by concentric striæ, which are often crowded and lamellose, producing a somewhat undulated character of the surface.

Interior unknown.

A large left valve has a length of 29 mm., height 18 mm., and hinge-line 20 mm. A smaller specimen has a length of 20 mm., height 13 mm., and hinge-line 14 mm.

This species resembles *P. sinuosa,* but the anterior end is wider; the wing is smaller and not produced at the extremity, and the radii are coarser. These two species are distinguished from the forms which follow by the large anterior end which is separated from the body by a broad byssal depression.

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* In the descriptions of the species of Ptychopteria and Leptodesma, the term auricle or ear is not so applicable to the anterior extension as in Actinopteria and Leiopteria and the term anterior end has been used for that portion of the shell anterior to the byssal sinus.

Formation and locality. In a coarse sandstone, from a bowlder containing the same associated fossils as a sandstone at Portville, Cattaraugus Co., N. Y.; probably of the Upper Chemung group; Smethport, McKean county, Pa.

PTYCHOPTERIA SINUOSA.

PLATE XXIII, FIG. 13; PLATE LXXXV, FIG 8.

Ptychopteria sinuosa, HALL. Pal. N. Y., vol. v, pt. 2. Plates and Explanations: Pl. 23, fig. 13. Jan., 1883.

SHELL of medium size, rhomboidal; body narrow-ovate, oblique at an angle of about 40° with the hinge; length more than one-third greater than the height; ante-byssal margin nearly vertical, curving into the broad sinus; base broadly rounded; posterior margin recurving into the wing.

Left valve convex below, gibbous in the middle and above. Right valve unknown.

Hinge-line straight, length four-fifths the length of the shell.

Beak at about the anterior third of the hinge, acute, directed forward. Umbonal region strongly gibbous, limited by the abrupt depression of the body on the posterior side, and by the byssal depression on the anterior side. Umbonal angle about 30°.

Anterior end large, narrow, rounded, defined by a broad, shallow, nearly vertical byssal depression; extremity angular. Wing narrow-triangular, extending nearly to the posterior extremity of the body; margin nearly vertical, slightly concave; extremity somewhat produced, angular.

Surface marked by fine undulating radii, which are less conspicuous on the wing, and by fine concentric lines of growth, which are crowded into subimbricating lamellæ. On the anterior side of the body the rays are cancellated by the elevated concentric striæ.

The ligamental area shows a sharp linear groove extending three-fourths of its length posterior to the beak, and a narrow cardinal tooth anterior to the beak and parallel to the hinge.

A large specimen of the left valve has a length of 31 mm., height 19 mm., and hinge-line 25 mm. A smaller one has a length of 24 mm., height 13 mm., hinge-line 20 mm.

This species has a narrower anterior end than the preceding, a larger and more extended wing, finer and undulating striæ.

Formation and localities. In sandstones of the Upper Chemung group, Smethport, McKean county, and at Warren, Warren county, Pa., associated with *Spirifera Verneuili.*

PTYCHOPTERIA SALAMANCA.

PLATE XXIII, FIGS. 17–20.

Ptychopteria Salamanca, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 17–20. Jan., 1883.

SHELL large, rhomboidal; body sub-ovate, oblique at an angle of about 40° with the hinge-line; length more than once and a half the height; ante-byssal margin oblique, rounded below, slightly concave at the sinus, and sloping to the broadly rounded base, thence abruptly recurved and continued almost vertically into the margin of the wing.

Valves convex, gibbous above the middle. The left valve is more gibbous than the right and somewhat larger.

Hinge-line straight, length more than three-fourths the length of the shell.

Beaks in front of the anterior third of the cardinal line, directed forward; the left beak prominent, acute, arching over the hinge; the right beak obtuse, depressed, scarcely rising above the hinge-line. Umbonal region gibbous, subtending an acute angle. The umbo and beak of the left valve are much more prominent, and the post-cardinal slope is obtusely sub-angular.

Anterior end comparatively small, triangular, produced into an acute extension. Wing large, triangular; margin gently concave; extremity produced, acute. The fold and sulcus are more conspicuous in the right valve.

Surface marked by fine, regular, undulating and interrupted radii, which are more conspicuous on the wing: crossing these are regular concentric lines, which are irregularly crowded into sub-imbricating lamellæ. On the anterior end of the valve the radii are cancellated by the concentric striæ.

Interior characters unknown, except a narrow groove along the ligamental area.

A left valve has a length of 41 mm., height 24 mm., hinge-line 32 mm. A similar right valve has a length of 40 mm., height 24 mm., hinge-line 34 mm.

This species varies in different conditions of preservation. The obtusely sub-angular appearance of the posterior slope is often exaggerated by lateral pressure or subdued by vertical pressure. The same is true of the folds of the wing. In some conditions the radiations are continuous, in others they are cancellated. In weathered specimens the striæ are sometimes nearly obsolete, and the concentric lamellæ more prominent.

Formation and locality. In the Chemung group, in a sandstone above the conglomerate at Rock City, near Salamanca, N. Y.

PTYCHOPTERIA SAO.

PLATE XXIII, FIGS. 16, 23; AND PLATE LXXXV, FIGS. 14-18.

Ptychopteria Sao. HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 16, 23. Jan., 1883.

SHELL of medium size, rhomboidal; body narrow, elongate-ovate, oblique at an angle of about 45° with the hinge-line; length one-third greater than the height; ante-byssal margin obliquely sub-truncate, gently curving into the sinus; base broadly rounded; posterior margin extended, abruptly recurved to the wing.

Valves convex; left valve larger and more convex than the right.

Hinge-line straight, longer than the height of the valve.

Beak in front of the anterior third of the cardinal line obtuse, prominent in the left valve and arching over the hinge; less prominent in the right valve, and rising just above the hinge. Umbo gibbous in the left valve, less gibbous in the right, subtending an acute angle.

Anterior end short, small, acute, limited by a shallow byssal depression. Wing large, triangular, extending to near the posterior extremity of the body; margin slightly oblique, scarcely concave; extremity apparently not produced.

Surface marked by fine radii which are more or less interrupted by the varices of the concentric striæ, and are frequently undulating. The concentric striæ are often fasciculate, and in their usual condition give an undulated appearance to the cast, but where well-preserved they are angular and somewhat lamellose.

Interior unknown, except a narrow groove along the ligamental area of the hinge.

A left valve of usual dimensions has a length of 30 mm., height 19 mm., hinge-line 23 mm. A similar right valve has a length of 31 mm., height 18 mm., and hinge-line 22 mm.

This species differs from *P. Proto* in its less angular posterior slope and posterior end; the margin of the wing is less oblique to the hinge and the extremity is not produced.

The specimens occurring in a conglomerate or coarse sandstone have been subjected to different degrees of pressure and maceration, and consequently present a great variety of aspect in the surface ornamentation. The furrow and fold limiting the wing are always less conspicuous in the left valve; and in some cases when the shell has suffered pressure these characters are very obscure.

Formation and locality. Abundant in a conglomerate of the Chemung group at Panama, Chautauqua county, N. Y.

PTYCHOPTERIA EUCRATE.

PLATE XXIII, FIG. 24; PLATE LXXXV, FIGS. 27, 28.

Ptychopteria Eucrate, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, fig. 24. Jan., 1883.

SHELL above the medium size, rhomboidal; body very narrow, elongate-ovate, oblique at an angle of about 30° with the hinge-line; length nearly twice the height; ante-byssal margin oblique, curving into the sinus; the ventral margin broadly curved; posterior extremity abruptly or sub-angularly recurved.

Left valve convex, gibbous on the umbo and obtusely sub-angular along the post-cardinal slope. Right valve less convex, somewhat smaller than the left.

Hinge-line straight; length about two-thirds the length of the valve.

Beak near the anterior fourth of the length of the hinge, directed forward; beak of left valve prominent, acute, incurved over the hinge-line; beak of right valve obtuse, and not elevated. Umbonal region of the left valve gibbous and angular, of the right valve convex, subtending a very acute angle.

Anterior end small; margin rounded; extremity acute. Byssal depression oblique, directed backward. Wing narrow, triangular, joining the body at the posterior end; margin obliquely truncate, scarcely concave; extremity apparently not produced.

Surface marked by fine radiating striæ, which are more conspicuous on the body of the valve and upon the wing, and are very obscure on the anterior end: these are crossed by fine concentric striæ of growth which, at irregular intervals, are raised into fascicles, usually more conspicuous on the umbo and post-cardinal slope. On the right valve the radii are usually obsolete.

Interior unknown, except the usual linear groove along the hinge-line.

A large left valve has a length of 40 mm., height 20 mm., and hinge-line 28 mm. Another is 38 mm. in length, height 20 mm., and hinge-line 27 mm.

In this species the body is more oblique than in *P. Salamanca;* the angularity of the left valve is in a direct line down the middle of the body; the shell is comparatively narrower; the extremity of the wing is not produced; the byssal depression is more oblique. The want of striæ on the anterior end and their obsolescence on the right valve are marked characters. It is proportionally much longer than *P. Sao,* with which it is associated.

Formation and locality. In the lower part of a conglomerate of the Chemung group at Panama, Chautauqua county, N. Y.

PTYCHOPTERIA THETIS, n. sp.

PLATE LXXXV, FIGS. 1-4.

SHELL of medium size, rhomboidal; body narrow-ovate, oblique at an angle of about 50° to the hinge-line; length one-third greater than the height; ante-byssal margin obliquely sub-truncate, and curving into a very shallow sinus, from which it makes a broad curve to the sub-angular posterior margin, whence it is abruptly recurved.

Left valve convex below, gibbous above, very obtusely sub-angular along the middle.

Hinge-line straight, length a little greater than the height of the valve.

Beak at about the anterior third of the hinge, prominent, arching over the cardinal line and directed forward. Umbonal region gibbous, subtending an acute angle.

Anterior end short, limited by a nearly vertical byssal depression; extremity acute. Wing of medium size, triangular, joining the body of the shell nearly at the posterior extremity; margin truncate, oblique; extremity apparently not extended.

Surface marked by concentric striæ, which are irregularly fasciculate, and have an angular recurvation along the middle of the body. The body and wing are marked by comparatively fine radii, which are sometimes distinctly cancellated by the concentric lines, and are obscure or obsolete on the anterior portion of the shell, which is marked only by the lamellose concentric striæ.

Interior unknown.

A specimen of the left valve of the usual size has a length of 32 mm., height 21 mm., and hinge-line 22 mm.

This species resembles *P. Sao*, but the angle of the body to the hinge-line is greater, and from the umbo to the posterior end, the valve is sub-angular; the hinge is longer in proportion, and the fold of the wing less conspicuous. A right valve in the same association has about the same proportions, but the body is narrower and the radii coarser, making the identity doubtful.

Formation and locality. In a conglomerate of the Chemung group at Panama, Chautauqua county, N. Y.

PTYCHOPTERIA FALCATA, n. sp.

PLATE LXXXV, FIGS. 6, 7.

SHELL of medium size, rhomboidal, sub-falcate; body narrow-ovate, oblique at an angle of about 45° with the cardinal line; length one-fourth greater than the height; anterior and basal margins broadly rounded; posterior margin abruptly recurved.

Left valve convex, gibbous above, arcuate. Right valve convex on the umbo, depressed-convex below.

Hinge-line straight, greater than the height of the shell.

Beak situated at about the anterior fourth of the cardinal line, prominent and arching over the hinge in the left valve; not elevated in the right valve. Umbo abruptly gibbous in the left valve, subtending an acute angle.

Anterior end limited by a shallow, nearly vertical byssal depression, which inclines backward in some specimens; margin convex; extremity acuminate. Wing triangular, joining the body near the posterior end; margin straight, slightly concave just below the hinge-line; extremity acute.

Surface of both valves marked by fine radiating striæ, which are less conspicuous on the wing and obsolete on the anterior end; and with concentric striæ, which are sometimes strongly lamellose, producing undulations of the surface.

Interior unknown.

A left valve has a length of 28 mm., height 22 mm., hinge line 24 mm. A similar right valve has a length of 28 mm., height 15 mm., and hinge-line 24 mm.

The shell of this species is comparatively longer, the body more oblique, and the wing smaller than in *P. Thetis*.

Formation and locality. In a sandstone and conglomerate of the Upper Chemung group at Alleghany Springs, Warren county, Pa.

PTYCHOPTERIA SPIO, n. sp.

PLATE LXXXV, FIG. 19.

SHELL of medium size, rhomboidal; body elongate-ovate, oblique to the hinge-line at an angle of about 30°; length considerably more than one-third greater than the height; ante-byssal margin curving into a shallow sinus; ventral margin broadly rounded; posterior margin abruptly recurved.

Left valve regularly and moderately convex, gibbous on the umbo. Right valve unknown.

Hinge-line straight, greater than the height of the valve.

Beak in front of the anterior third, moderately prominent and scarcely rising above the hinge.

Anterior extremity narrowly acute. Wing very obliquely truncate, joining the body near the posterior extremity; the furrow and fold separating it from the body are only moderately developed; extremity not produced.

Test thin, marked by fine undulating radii which are obsolete on the anterior side; also by concentric striæ which are prominent and lamellose on the anterior.

Interior unknown.

The specimen described has a length of 35 mm., height 20 mm., hinge-line 24 mm.

This species differs from *P. Eucrate* in its comparatively greater height; it is less gibbous in the left valve, the posterior end not angularly produced, the byssal depression less conspicuous, and the radii finer. It differs from *P. Sao* in its lesser gibbosity, greater obliquity of the wing margin, and the generally subdued characters of the surface markings.

Formation and locality. In a conglomerate of the Chemung group, Panama, Chautauqua county, N. Y.

PTYCHOPTERIA EUDORA, n. sp.

PLATE LXXXV, FIG. 9.

SHELL of medium size, rhomboidal; body narrow, elongate-ovate, oblique at an angle of about 30° with the hinge-line; length nearly twice the height; ante-byssal margin oblique, curving into the long, shallow sinus; base broadly curved; posterior end acutely recurved.

Left valve gibbous above, convex below. Right valve unknown.

Hinge-line straight, greater than the height of the shell.

Beak a little in front of the anterior third of the hinge directed forward, rising above the cardinal line. Umbo narrow and gibbous, subtending a very acute angle.

Anterior end small, limited by a well-marked and oblique byssal depression; extremity acute. The distance from the byssal sinus to the cardinal margin is one-half the greatest height of the valve. Wing joining the body one-fourth its length above the posterior end; the shallow furrow and fold defining its limits are not strongly marked; margin obliquely truncate; extremity not produced.

Test thin, marked by radii which are very fine and undulating on the body and wing, while they are obsolete on the anterior portion; these are cancellated by fine concentric striæ, which on some portions are fasciculate, and very conspicuous on the anterior end.

Interior unknown.

The specimen described has a length of 36 mm., height 20 mm., and hinge-line about 23 mm.

This species bears considerable resemblance to *P. Eucrate*, but its anterior end is proportionally narrower, and it may also be distinguished by the absence of a continuous angularity along the body, the more abrupt recurving of the post-basal margin, the more oblique truncation of the wing, and the less conspicuous surface markings. It differs from *P. Spio* in its more gibbous umbo and more elevated beak, narrower anterior end, more abrupt recurving of the posterior margin, and conspicuous byssal sinus.

Formation and locality. In a conglomerate of the Chemung group at Panama, Chautauqua county, N. Y.

PTYCHOPTERIA ALATA.

PLATE XXIII, FIGS. 25, 26 (21, 22?); AND PLATE LXXXV, FIG. 26.

Ptychopteria alata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 25, 26 (21, 22?). Jan., 1883.

SHELL large, broadly rhomboidal; body sub-cylindrical. oblique at angle of about 45° with the hinge-line; height less than two-thirds the greatest length; anterior margin oblique, sloping into the broad curvature of the base; posterior margin recurved almost rectangularly, slightly acute.

Left valve gibbous and angular along the axis of the body from the umbo to the post-basal extremity. Right valve less convex, and less angular in character than the left.

Hinge-line straight, about one-sixth less than the greatest length of the valve.

Beak very prominent in the left valve, directed forward; more depressed in the right valve; situated at about the anterior fifth of the cardinal line.

Anterior extremity in the right valve small, triangular, acute. Wing large, triangular, joining the body at the posterior extremity; the limiting furrow is obscure in the left valve, but very marked in the right; margin of wing gently concave, nearly vertical; extremity angular, little produced.

Surface marked by fine radii which (in the specimens seen) are obscure in the left valve and nearly obsolete in the right; and by concentric striæ which are crowded into imbricating ridges.

Some small right valves found in the same association, and referred with doubt to this species, preserve the radii in a much stronger degree.

Interior unknown.

A large right valve has a length of 42 mm., height 26 mm., and hinge-line 35 mm.

This species is distinguished by the great contrast in the convexity of the two valves. The left valve is strongly angular and elevated from the umbo to the posterior extremity; the right valve is conspicuously alate.

Formation and locality. In a coarse sandstone of the Chemung group, near Salamanca, N. Y.

PTYCHOPTERIA TRIGONALIS, n. sp.

PLATE LXXXV, FIGS. 34, 35.

SHELL small or of medium size, rhomboidal; body sub-cylindrical, oblique at an angle of about 45° with the hinge-line; length one-third greater than the height; anterior margin rounded, gently curving into the broad base, with a faint byssal sinus; posterior margin almost rectangularly recurved.

Left valve convex, gibbous on the umbo, and angular from the umbo to the post-basal extremity. Right valve unknown.

Hinge-line straight, length greater than the height of the valve.

Beak in front of the anterior third of the hinge, obtuse, prominent and incurved. Umbonal region gibbous, subtending an acute angle.

Anterior end short, rounded, indistinctly separated from the body by an obscure byssal sinus. Wing large, triangular, joining the body of the valve near the posterior extremity; the limiting furrow is very distinct in young shells, and obscure in older examples; margin somewhat obliquely truncate; extremity not produced.

Surface marked by fine radii, which are obscure or obsolete on the anterior part of the shell; also by concentric striæ, which are somewhat acutely recurved on the angular portion of the body, and in older shells are fasciculate, producing an undulated aspect.

Interior unknown.

A small left valve has a length of 16 mm., height 11 mm., and hinge-line 13 mm. Another specimen has a length of 30 mm., height 18 mm., and hinge-line 25 mm.

This species has some resemblance to *P. alata* in the left valve, but its height is comparatively greater, the wing more truncate, and not produced at the extremity.

Formation and locality. In a shaly sandstone above a conglomerate in the upper part of the Chemung group at Panama, Chautauqua county, N. Y.

PTYCHOPTERIA ELONGATA, n. sp.

PLATE LXXXV, FIGS. 10-13.

SHELL of medium size, sub-rhomboidal, elongate; body sub-cylindrical, oblique at an angle of 30° with the hinge-line; length more than one-third greater than the height; anterior margin oblique, curving into the basal margin, with a slight concavity for the byssal sinus; posterior margin abruptly rounded.

Left valve regularly convex below, gibbous above. Right valve somewhat depressed-convex.

Hinge-line straight, about one-fifth less than the length of the valve.

Beaks near the anterior fourth of the hinge, directed forward; left beak prominent, sub-acute, arching over the cardinal line; beak of right valve depressed, obtuse, scarcely rising above the hinge-line. Umbo gibbous in the left valve; the greatest convexity of the valve is about one-third the length from the beak. Umbonal angle acute.

Anterior end short, produced and acute at the extremity, limited by a distinct oblique byssal depression. Wing narrow-triangular, joining the body of the shell near the posterior extremity, limited by a furrow which is not conspicuous in the lower part, but in the right valve is more marked; margin obliquely truncate.

Surface marked by fine radii, which are distinctly cancellated by the concentric striæ, when the specimen is tolerably well-preserved; also by concentric lines of growth which, at somewhat regular intervals, are sharply elevated. The radii are obsolete on the anterior of the valve, and the concentric striæ are lamellose.

The connected valves show a narrow ligamental area extending half the length of the hinge. Other characters of the interior are unknown.

One specimen has a length of 35 mm., height 21 mm., and hinge-line 25 mm. Another has a length of 25 mm., height 13 mm., and hinge-line 20 mm.

This species resembles *P. Eucrate*, but is less gibbous, more elongate, and without angularity along the body.

Formation and locality. In a conglomerate of the Chemung group at Panama, Chautauqua county, N. Y.

PTYCHOPTERIA GALENE, n. sp.

PLATE LXXXV, FIGS. 29-31.

SHELL small, rhomboidal; body sub-elliptical, oblique at an angle of about 40° with the hinge; height greater than half the length; ante-byssal margin oblique, curving gently into a shallow sinus; base regularly rounded; posterior end abruptly recurved.

Left valve convex, moderately gibbous on the umbo, and sub-angular along the upper half. Right valve less convex above, depressed-convex in the lower part.

Hinge-line straight, length greater than the height of the valve.

Beaks near the anterior third of the hinge, inclined forward, prominent, arching over the hinge-line. Umbo gibbous, subtending somewhat less than a right angle.

Anterior end small, limited by the shallow, nearly vertical byssal depression; extremity acute. Wing wide-triangular, joining the body near the posterior end; limiting furrow distinct; fold wide and moderately prominent; margin obliquely truncate, very slightly concave just below the hinge-line; extremity angular.

Surface of the body and wing marked by regular, fine, interrupted or undulating radii, which are obscure or obsolete on the anterior portion; also by very fine concentric lines, which are crowded into irregular fascicles and are lamellose on the anterior part of the valve.

Interior unknown.

A left valve has a length of 26 mm., height 18 mm., and hinge-line 20 mm. Another specimen has a length of 24 mm., height 14 mm., and hinge-line 17 mm.

Compared with *P. Eucrate* and *P. elongata*, the body of the shell is comparatively shorter, the furrow of the wing more distinct, the byssal depression shallower and more nearly vertical. It has the obscure angularity of *P. Eucrate*, with coarser and more nearly vertical radii.

Formation and locality. In the lower beds of the Upper Division of the Chemung group, as seen at Warren, Pa.

PTYCHOPTERIA BEECHERI, n. sp.

PLATE LXXXV, FIGS. 21, 22.

SHELL large, rhomboidal; body cylindrical, very arcuate in the left valve, oblique at an angle of about 40° with the hinge; length nearly twice the height; ante-byssal margin slightly oblique, curving gently into the sinus; ventral margin broadly rounded, straighter toward the posterior end, which is acutely recurved.

Left valve ventricose, the greatest convexity a little above the middle; abruptly rounded or sub-angular along the post-cardinal slope, and the elevation is continued into the angular posterior extremity. Right valve much less convex.

Hinge-line straight, length more than two-thirds the length of the shell.

Beaks at about the anterior third of the hinge-line, very prominent and incurved over the hinge in the left valve. In the right valve the beak is subdued, not rising above the hinge-line. Umbo very gibbous in the left valve, subtending an acute angle.

Anterior end moderately large, limited by a very broad, shallow, slightly oblique byssal depression; extremity flattened, acute, defined by an oblique constriction in the margin just below the cardinal line. Wing of medium size, joining the body of the shell a little above the posterior extremity;

the limiting furrow distinct; the fold gentle and the upper part of the wing flat or slightly convex; margin obliquely truncate, concave just below the hinge; extremity slightly produced.

Surface marked by fine uniform radii on the body and wing, which are nearly obsolete on the anterior end, and sometimes interrupted on the body by varices of growth; also by fine concentric striæ which are acutely recurved over the angular posterior slope of the body, and crowded into fascicles at irregular intervals, producing an undulated appearance.

Interior unknown.

A large left valve has a length of 52 mm., height 28 mm., and hinge-line 36 mm. A right valve in the same association has a length of 40 mm., height 20 mm., and hinge-line 33 mm.

This species somewhat resembles *P. trigonalis*, but the posterior extremity is more produced, and the wing more obliquely truncate on the margin. The right valve in general aspect resembles the right valve of *P. alata*, but the left valve is very dissimilar. The distinguishing characters are its large rhomboidal form, extreme gibbosity and arcuation of the left valve.

Formation and locality. In a compact sandstone of the Upper Chemung group, in the lower beds as seen at Warren, Pa.

Ptychopteria spatulata, n. sp.

PLATE LXXXV, FIG. 20.

Shell large, elongate, rhomboidal; body sub-elliptical, oblique at an angle of about 30° with the hinge; length more than one-third greater than the height; ante-byssal margin oblique, gently curving into the sinus, thence extending into the broadly curved basal margin; posterior end rectangularly or acutely recurved.

Left valve moderately convex, slightly gibbous above. Right valve depressed-convex, more sub-angular along the post-cardinal slope, and smaller than the left.

Hinge-line straight, length about one-seventh less than the greatest length of the valve.

Beaks at about the anterior fourth, prominent and incurved over the hinge-line in the left valve; depressed in the right valve and not rising above the cardinal line. Umbonal angle nearly rectangular.

Anterior end large, limited by a broad, slightly oblique, undefined byssal depression; extremity acute and nasute. Wing elongate triangular, joining the body at the posterior end; the dividing furrow distinct in the left valve, more conspicuous in the right; the fold is not defined in the left valve, and is strongly marked in the right; margin nearly vertically truncate; extremity not perceptibly produced.

Test thin, marked by fine radii, which are conspicuous upon the body and wing, and obsolete on the anterior end and byssal depression. The surface is also marked by fine concentric striæ, which are crowded into fascicles, giving an apparent undulation to the surface from the umbo to the lower extremity, especially in the right valve. At the post-basal margin the striæ are recurved at a little less than a right angle in the left valve, and more acutely in the right valve, and they are strongly lamellose on the anterior end.

Interior unknown.

The specimen described has a length of 56 mm., height 30 mm., and hinge-line about 48 mm.

This species resembles *P. lata*, and also some forms of *P. Sao*, but it is much more elongate, the valves more depressed, the wing narrower and longer.

Formation and locality. In the Upper Chemung group at Warren, Pa.

PTYCHOPTERIA LATA, n. sp.

PLATE LXXXV, FIGS. 23-25.

SHELL large, rhomboidal; body sub-elliptical, very oblique, making an angle with the hinge of nearly 40°; height equal to about two-thirds of the length; ante-byssal margin oblique, curving into the shallow sinus, from whence the basal margin is broadly rounded; posterior extremity recurved at a little less than a right angle.

Left valve more convex than the right and gibbous above, obscurely angular along the post-cardinal slope. This difference in the valves is also shown in the direction of the striæ of growth.

Hinge-line straight, about three-fourths as long as the length of the shell.

Beaks near the anterior fourth of the hinge, prominent in the left valve, acute, arching over the cardinal line; in the right valve depressed, rising only as high as the hinge. Umbonal region of the left valve moderately gibbous, subtending an acute angle.

Anterior end short, small, limited by an oblique byssal depression which extends along the base about one-third the length of the shell; extremity acute. Wing large, extending along the shell to near the posterior extremity; margin obliquely truncate, concave just below the hinge-line, which is abruptly produced.

Test thin, marked by fine, interrupted or undulated radii, which are more strongly marked on the body and wing, and obsolete on the anterior of the valve; the surface is also marked by fine concentric striæ, which are crowded into fascicles at unequal distances, undulating the surface; they turn abruptly outward, just below the hinge, and are lamellose on the anterior part of the valve.

Interior unknown.

A specimen preserving both valves has a length of 45 mm., height 28 mm., hinge-line 35 mm. The right valve is somewhat smaller. Another specimen has a length of 42 mm., height 28 mm., hinge-line 36 mm.

This species resembles in form *P. Sao*, but is larger, the wing furrow more strongly defined on the left valve, the concentric lines more acutely recurved at the basal angle, and the radii are finer and more numerous.

Formation and locality. In the Upper Chemung group, the middle beds of the series, as seen at Warren, Pa.

PTYCHOPTERIA PERLATA, n. sp.

PLATE LXXXV, FIGS. 38, 39.

SHELL large, rhomboidal; body ovate, oblique; length one-sixth greater than the height; anterior and basal margins broadly curved; posterior end angular.

Left valve very convex, gibbous above. Right valve somewhat gibbous above, having a convexity of about one-half that of the left valve.

Hinge-line straight, nearly equal to the length of the shell.

Beak at about the anterior third of the cardinal line, prominent and arching over the hinge in the left valve. Umbo gibbous in the left valve and convex in the right, subtending an acute angle.

Anterior end large, obscurely defined by a shallow byssal depression, which is obsolete in the right valve; margin convex; extremity acuminate. Wing broad triangular, joining the body at the posterior end; the furrow and fold are stronger in the left valve; margin slightly convex below, inclining a little forward; extremity produced, acute-angular.

Surface of the left valve marked by fine, close, rounded radii, which are often interrupted by the concentric lamellæ. The radii are finer upon the wing, obsolete upon the anterior end, and scarcely present on the right valve. The concentric lines of growth and lamellæ, give an irregularly undulating appearance to the surface.

Interior unknown.

A left valve has a length of 31 mm., height 26 mm., and hinge-line 30 mm. A right valve measures 33 mm. in length, 27 mm. in height, and hinge-line 32 mm.

This species is a shorter, more erect form than *P. lata*, and the left valve is more convex and broader below.

Formation and locality. In the upper beds of the Chemung group at Warren, Pa.

PTYCHOPTERIA THALIA, n. sp.

PLATE LXXXV, FIGS. 32, 33.

SHELL of medium size, rhomboidal; body ovate, oblique at an angle of about 45° with the cardinal line; length one-third greater than the height; anterior and basal margins broadly rounded, slightly impressed by the byssal sinus; post-basal extremity sub-angular, abruptly recurved.

Left valve extremely gibbous, the point of greatest convexity is one-third of the height from the beak. Right valve convex on the umbo, depressed-convex below.

Hinge-line straight, a little less than the greatest length of the shell.

Beak situated at the anterior third of the hinge, prominent in the left valve, curving over the hinge-line. Umbonal region abruptly gibbous in the left valve, distinctly limited, subtending an acute angle.

Anterior end comparatively large, limited by a nearly vertical shallow byssal depression; margin convex; extremity acute. Wing small, distinctly limited by the post-umbonal furrow; margin obliquely truncate, a little convex; extremity obtuse-angled.

Surface of both valves marked by fine radii originating on the umbo, becoming stronger on the lower part of the body, less conspicuous on the wing, and obsolete on the anterior end; and by lines of growth which are lamellose on the anterior side and produce unequal concentric ridges on the body of the valve.

Interior unknown.

A left valve has a length of 25 mm., height 17 mm., and hinge-line 23 mm. A small right valve has a length of 20 mm., height 13 mm., and hinge-line 16 mm.

This species resembles *P. perlata* but the wing is comparatively smaller, extremity not acuminate, and the umbo more gibbous.

Formation and locality. In a sandstone of the Upper Chemung group at Alleghany Springs, Warren county, Pa.

PTYCHOPTERIA GIBBOSA, n. sp.

PLATE LXXXV, FIG. 5.

SHELL small, rhomboidal; body broad-ovate, oblique at an angle of about 45° with the hinge-line; length not more than one-seventh greater than the height; ante-byssal margin oblique, curving into the marked sinus, thence along the base to the nearly rectangularly recurved posterior extremity.

Left valve very convex, gibbous on the umbo and in the middle. Right valve unknown.

Hinge-line straight, nearly as long as the length of the shell.

Beaks a little anterior to the middle of the hinge; very prominent in the left valve and arching over the hinge. Umbonal region ample, very gibbous, obscurely angular along the posterior slope, subtending an acute angle.

Anterior end somewhat large, gibbous, and separated from the body of the shell by a nearly vertical sulcus; extremity acute and nasute. Wing of medium size, joining the body at the posterior end; the furrow and fold are very conspicuous, the fold somewhat broader and nearly equal to the portion of the wing above; margin almost vertically truncate; extremity apparently not produced.

Test thin, marked by fine radii and concentric striæ. The concentric lines are crowded into fascicles, producing an undulated appearance; and are strongly lamellose on the anterior end; the radiating striæ are distinct upon the body of the shell, obscure on the wing, and obsolete on the anterior end.

Interior unknown.

A specimen of the left valve has a length of 26 mm., height 15 mm., hinge-line 22 mm. Another has a length of 20 mm., height 13 mm., hinge-line 18 mm.

This species is distinguished by the sub-central position of the beak, and the great prominence of the umbo; the marked byssal depression, and strong furrow and fold of the wing.

Formation and locality. In the upper beds of the Chemung group at Warren, Pa.

PTYCHOPTERIA LOBATA, n. sp.

PLATE LXXXV, FIG. 37.

SHELL small, sub-rhomboidal; body broadly ovate, oblique at an angle of about 55° with the cardinal line; length somewhat greater than the height; anterior margin sub-truncate; base broadly rounded; posterior margin rectangularly recurved into the wing.

Left valve very gibbous; the point of greatest convexity is just below the umbo. Right valve unknown.

Hinge-line straight, length nearly equal to the length of the valve.

Beak situated anterior to the middle of the hinge, prominent, inclined forward, and arching over the margin of the valve. Umbonal region ample, gibbous, subtending an acute angle.

Anterior end large, limited by a broad, undefined byssal depression; margin convex; extremity apparently obtuse. Wing small, joining the body at the posterior end, strongly limited by a deep furrow and very marked alar plication; margin nearly straight; extremity angular.

Surface marked by fine radiating striæ which become finer on the wing and anterior end; and by striæ of growth which are somewhat lamellose on the anterior of the shell.

Interior unknown.

A left valve of this species has a length of 13 mm., height 10 mm., hinge-line 11 mm.

This species differs from *P. gibbosa* in its shorter, truncate anterior end, and stronger fold on the wing, which is comparatively stronger than in any species yet observed.

Formation and locality. In the sandstones of the Upper Chemung group, Warren county, Pa.

PTYCHOPTERIA VANUXEMI, n. sp.

PLATE LXXXV, FIG. 36.

SHELL large, sub-triangular; body narrow-elongate, sub-cylindrical, oblique at an angle of nearly 30° with the hinge-line; ventral margin very long and gently curving; posterior margin abruptly and acutely recurved.

Left valve very convex along the axis of the body. Right valve unknown.

Hinge-line straight, length more than one-fourth greater than the height, or about two-thirds the entire length of the shell. Umbonal angle very acute.

Anterior end unknown. Wing very large, triangular, joining the body near the posterior end; the furrow and fold obscure; margin obliquely truncate to near the hinge, where it is concave and abruptly recurved into the produced extremity.

Test thin, marked by strong radii, and by fine, sharp, equidistant, lamellose concentric striæ. The concentric striæ are crowded and somewhat fasciculate on the posterior and the wing, giving an undulated or imbricated appearance. The rays are very strong over the middle of the body, and subdued on the wing and basal side, and are distinctly crenulated by the elevated concentric lines, with the interspaces cancellated.

Interior unknown.

The specimen described has a length of 70 mm., height 34 mm., and hinge-line about 44 mm.

This species is conspicuously distinct from any other; in outline it approaches some of the extreme forms of *Pteronites*.

Formation and locality. In the highest beds of the Upper Chemung group at Warren, Pa.

PTYCHOPTERIA EXPANSA.

PLATE XXIII, FIGS. 10, 11.

Ptychopteria expansa, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 10, 11. Jan., 1883.

SHELL of medium size, sub-rhomboidal; body ovate, oblique at an angle of about 60° with the hinge-line; length one-fifth greater than the height; ante-byssal margin oblique, gently curving into the shallow sinus; basal margin broadly rounded to the base of the wing.

Left valve convex below, gibbous above. Right valve unknown.

Hinge-line straight, central, length greater than the length of the valve.

Beak at about the anterior fifth of the hinge, inclined acutely forward, moderately prominent. Umbonal angle acute.

Anterior end small, surface convex to the nearly vertical byssal depression which extends half way to the base of the shell; extremity compressed and acute. Wing very large, triangular, extended, joining the body at the posterior extremity; the furrow obscurely marked; margin gently concave, extending backward; extremity produced.

Surface marked by regular strong radii and by concentric lines of growth. The concentric striæ are sometimes crowded into irregular fascicles, giving an undulated appearance to the surface; the radii are strong on the umbonal slope, less conspicuous on the wing, and on the antero-basal portion they are interrupted, and oblique to those on the umbo.

Interior unknown.

The specimen described has a length of 27 mm., height 22 mm., and hinge-line 30 mm.

This species is distinguished by its erect form, large and extended wing, and peculiar character of surface markings. The furrow of the wing is indicated only by a wider depression between the radii, and a stronger ray marks the fold.

Formation and locality. In a coarse sandstone of the Chemung group near Smethport, Pa.

GLYPTODESMA, Hall.

Glyptodesma erectum.

PLATE XI, FIGS. 1-10; PLATE XII, FIGS. 1-3, 5-9; PLATE XIII, FIGS. 1-4, 12-15; PLATE XXV, FIGS. 14-17; PLATE LXXXVI, FIGS. 1-8; AND PLATE LXXXVII, FIGS. 1-3.

Avicula erecta, Conrad. Jour. Acad. Nat. Sci., Phila., p. 238, pl. 12, fig. 5. 1842.
" *cruciformis,* Conrad. Geolog. Surv. N. Y.: Annual Report, p. 54. 1841.
Actinodesma erectum (Conrad), Hall. MS., Pal. N. Y. 1877.
" " " S. A. Miller, in Cat. Amer. Pal. Foss. 1877.
" *cruciforme* (Conrad), Hall. MS., Pal. N. Y. 1877.
" " " S. A. Miller, in Cat. Amer. Pal. Foss. 1877.
Glyptodesma erectum (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 11, figs. 1-10; pl. 12, figs. 1-3, 5-9; pl. 13, figs. 1-4, 12-15; pl. 25, figs. 14-17. Jan., 1883.

Shell large; body ovate, acute, erect or moderately oblique; wings more or less expanded, often greatly expanded; height frequently one-third greater than the length; basal margin more or less regularly rounded; anterior side broadly convex; posterior side nearly straight or slightly concave.

Valves very unequal. Left valve varying from moderately convex to gibbous and arcuate. Right valve depressed-convex in the umbonal region, flat or concave below; variable in convexity.

Hinge-line straight, often greatly extended, equalling or usually greater than the length of the valve.

Beak of left valve prominent, acute, inclined forward, rising above the hinge-line, and situated anterior to the middle of the body of the shell. Umbonal region somewhat prominent, often gibbous, limited anteriorly by a distinct rounded sulcus, and posteriorly by an interruption and change in the direction of the striæ, which sometimes produces a defined line of separation. Umbonal angle acute.

Anterior wing auriform and small in young specimens, becoming expanded and variously extended in older specimens, limited by a distinct byssal depression; extremity rounded. Posterior wing large, triangular; margin concave; extremity often extended beyond the margin of the shell.

Test thick, marked by fine, irregular, concentric striæ of growth which are sometimes raised into sharp lamellæ, or crowded into prominent fascicles.

These striæ become more conspicuous upon the margins and upon the wings, where they are often highly lamellose. The distant lamellæ which mark the body of the shell are sometimes continued upon the hinge, and becoming stronger, curve over the margin, giving it a sharply annulated aspect, which, when preserved in the impression of the hinge-border, might be mistaken for a more important organic marking. Partially exfoliated shells show some obscure radiating lines which belong to the intimate shell-structure, and are not external. (These striæ are too conspicuously represented in figure 6 of plate xii.)

Posterior muscular impression situated near the middle of the posterior slope, and marked by irregular vascular striæ; from the lower anterior side of this impression the pallial line extends slightly downward, curving forward, and continuing in a line nearly parallel to the margin it terminates in a small muscular impression within the rostral cavity. The pallial line is frequently pitted or interrupted in its course, and from these pits radiating grooves extend toward the margin of the shell.

Ligamental area extending the entire length of the hinge, comparatively wide, grooved longitudinally with fine, continuous parallel lines. Hinge with one or two linear, slightly oblique, lateral teeth on the posterior side, and with numerous erect or oblique irregular folds along the cardinal line below the ligamental area, which terminate on the inner margin in distinct crenulations. The cardinal wrinkles are smaller and more regular anteriorly, becoming large and irregular posterior to the beak.

Three large specimens have the following respective dimensions: length 90, 70, and 81 mm., height 100, 99, and 81 mm.; hinge-line 100, 90, and 90 mm. An example of medium size has a length of 55 mm., height 76 mm., and hinge-line 48 mm. A large, erect individual measures 72 mm. in length, and 90 mm. in height. A small right valve has a length of 23 mm., height 27 mm., and hinge-line 33 mm.

This is an abundant species and attains a very large size in older individuals. In its different conditions of growth and preservation, it presents a very great variety of aspect, and it becomes extremely difficult to determine the limits of the species. In the young shell the posterior wing is proportionally more extended than in older individuals, while the anterior wing is usually smaller. During the progress of growth, both wings often become extravagantly developed, and the form and proportions of these parts cannot be relied upon for specific distinctions. The characteristic forms have the body nearly erect, with the umbo and beak directed slightly forward; but associated with these, are other forms which present a considerable degree of obliquity in the body of the shell, and while there seem to be no constant marks of specific distinction, it is extremely unsatisfactory to group them all under one species.

The interior characters also present considerable differences, the number of lateral teeth varying from one to three; the cardinal wrinkles and crenulations not only vary in number and strength, but in their direction, which is vertical or oblique. There is also a very great difference in the width of the ligamental area.

Formation and localities. In the shales and shaly sandstones of the Hamilton group, from the eastern limit of the formation as far west as Canandaigua lake; it is extremely abundant in Albany and Schoharie counties; Cazenovia and Hamilton, in Madison county, and at Pratt's falls, in Onondaga county, N. Y. This species is also found in a cherty limestone in Clarke county, Indiana; and in similar conditions and associations at several localities in Ohio.

GLYPTODESMA ERECTUM, var. OBLIQUUM.

'PLATE XII, FIG. 4; AND PLATE XIII, FIGS. 5-11.

Glyptodesma erectum, var. *obliquum*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 12, fig. 4; pl. 13, figs. 5-11. Jan., 1883.

THIS variety possesses the essential characters of the typical forms of the species. The hinge, test, etc., are similar, but the body of the shell is distinctly oblique; the wings are less developed, and the anterior wing, especially, has not the great extension often observed in the erect forms.

The specimens of this variety are uniformly smaller. They have been observed mainly in the soft shales at Pratt's falls, Onondaga county, while the large erect forms are common in the coarse shales and grits of the group in the eastern portion of the State, and in Madison county.

In examining and comparing the extreme forms, the difference is striking and distinctive. (For example, the erect forms on plate xi, and the oblique forms, figures 5 to 11, plate xiii.) But in the study and comparison of a series of several hundred specimens, the intermediate forms appear to unite the whole under a single species.

To facilitate the examination, the oblique forms, represented in figures 5–11 of plate xiii, are here designated as *G. erectum*, var. *obliquum*.

The description of *Avicula erecta*, and *A. cruciformis*, given by Mr. Conrad, are as follows, loc. cit.:

" AVICULA *erecta*, pl. 12, fig. 5.—Direct; independent of the wings, of ovate " acute outline; left valve ventricose, concentrically wrinkled, or marked with " lines of growth; apex prominent, narrow, acutely rounded; posterior wing " elongated, pointed; basal margin uniting with the lateral margins in a regular " curve or arch.

Locality—Hamilton, Madison county, New York.

" *Avicula cruciformis*, Conrad, loc. cit.: " Elevated, with both ears greatly " elongated. *Locality*—Near Oneonta: This species is remarkable for the great " proportional height; very little oblique. Height 3½ inches."

The name of *A. cruciformis* has precedence in point of time, but the name of *A. erecta* has been adopted because the description and figure entitle it to recognition, and the former name is only applicable to the more extravagant forms of the species illustrated on plates xi and xii.

GLYPTODESMA OCCIDENTALE.

PLATE XV, FIG. 12; AND PLATE LXXXVI, FIG. 9.

Glyptodesma occidentale, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 15, fig. 12. Jan., 1883.

SHELL large, broadly ovate; body nearly erect; height and length about equal; margins regularly curved.

Left valve very convex, gibbous on the umbo. Right valve unknown.

Hinge-line straight, equalling or greater than the length of the shell.

Beak anterior to the middle of the shell, directed slightly forward, acute and prominent. Umbonal region gibbous, defined anteriorly by the broad sulcus, and on the anterior side sloping abruptly to the wing.

Anterior wing short, defined by a deep sulcus and a marked byssal sinus. Posterior wing large, depressed-convex, much extended, joining the body of the shell below the middle, and defined only by the recurving of the striæ; margin concave; extremity acute.

Test thick, marked by numerous fine striæ of growth, which at intervals are crowded into fascicles, producing an undulating surface. The striæ are more closely arranged, and become lamellose on the anterior part of the shell. On the posterior wing the striæ are regular, and at distant intervals a single stria becomes sharply elevated.

Interior unknown.

The specimen of this species described has a length 60 mm., height 66 mm., and hinge-line equal to, or greater than the length of the shell.

This species resembles *G. erectum*, but appears to be a more robust form; the shell is more orbicular, the umbonal region more gibbous, the surface more rugose from the undulations of the fascicles of striæ, and the limitation between the body and the posterior wing is less strongly defined.

Formation and localities. In the limestone of the Upper Helderberg group at the falls of the Ohio, near Louisville, Kentucky, and in Clarke county, Indiana.

LEIOPTERIA, HALL.

LEIOPTERIA LÆVIS.

PLATE XVII, FIGS. 5-11; AND PLATE XX, FIG. 5.

Avicula lævis, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 181. 1843.
Pteronites lævis, (HALL) S. A. MILLER. Cat. Amer. Pal. Foss., p. 202. 1877.
Leiopteria lævis, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, figs. 5-11. Jan., 1883.

SHELL small, sub-rhomboidal; body obliquely ovate; length and height nearly equal; greatest length below the middle; margins regularly rounded, somewhat extended on the post-basal side.

Left valve more convex than the right; the greatest convexity in both valves is above the middle.

Hinge-line straight on the posterior side of the beak, turning abruptly downward in front; entire length greater than the length of the shell.

Beaks obtuse, rounded, inclined forward, situated at the anterior third of the shell, that of the left valve quite prominent. Umbonal region of left valve prominent, subtending an acute angle.

Ear triangular, nearly equilateral, with a strong angular fold along the middle, separated from the body of the valve by a distinct rounded sulcus and broad byssal sinus; margin rounded; extremity obtuse. Wing triangular, flat, limited by the post-umbonal slope; margin concave; extremity acute.

Test thin, marked with distinct concentric striæ of growth, which are crowded and conspicuous on the wings. There are often obscure traces of radii, which are more distinct on the wing in casts or exfoliated specimens.

Ligamental area narrow, with a single distinct groove. Some specimens apparently indicate the existence of an oblique lateral tooth on the posterior side of the umbo.

One specimen has a length of 11 mm., height 12 mm., hinge-line about 10 mm. Another has a length of 10 mm., height 11 mm., and hinge-line 12 mm. A small specimen is 8 mm. in length, 9 mm. in height, and hinge-line 10 mm.

Formation and localities. In the Marcellus shale at Littleville, Livingston county; Alden, Erie county, and East Bloomfield, Ontario county, N. Y.

LEIOPTERIA CONRADI.

PLATE XX, FIGS. 1, 2, 4; AND PLATE LXXXVIII, FIGS. 1-4.

Leiopteria Conradi, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 20, figs. 1, 2, 4, (5 in error). Jan., 1883.

SHELL above the medium size, sub-rhomboidal; body oblique-ovate; length a little greater than the height; anterior margin straight, nearly vertical; basal and posterior margins regularly rounded.

Valves sub-equally convex; the left valve somewhat more convex than the right.

Hinge-line straight, longer than the length of the valve, greatly extended posteriorly.

Beaks acute, directed forward, prominent, situated near the anterior end of the shell. Umbonal region gibbous (in well-preserved shells), moderately convex below, subtending an acute angle.

Ear short, separated from the valve by a rounded depression or sulcus, marked by a shallow, elongate byssal sinus; extremity rounded. Wing triangular, much extended; margin concave; extremity acuminate.

Test, as indicated by casts or partially exfoliated specimens, marked by fine, closely arranged, concentric lines of growth, which at irregular intervals are crowded and raised into rounded or sub-angular fascicles, giving the surface a decidedly undulated aspect. The striæ become more crowded upon the cardinal expansions, especially upon the ear.

Ligamental area marked by a single longitudinal groove parallel to the hinge-line.

Two specimens of the left valve have respectively the following dimensions: length 39, and 42 mm., height 32, and 36 mm., hinge-line 42, and 47 mm.

This species bears some general resemblance in form to *Actinopteria decussata* and *A. Boydi*, but is distinguished by the absence of rays. It differs from *L. Greeni*, fig. 9, pl. xx, in its more oblique form and greater proportional length.

Formation and localities. In shales of the Hamilton group, on the shore of Canandaigua lake, and at Bellona, Yates county, N. Y.

LEIOPTERIA GREENI.

PLATE XX, FIGS. 9, 12; AND PLATE LXXXVIII, FIGS. 21, 22.

Leiopteria Greeni, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 20, figs. 9, 12. Jan., 1883.

SHELL large, sub-rhomboidal; body moderately oblique, broadly ovate; length a little greater than the height; margins regularly rounded, somewhat extended posteriorly.

Valves moderately and nearly equally convex; similar in character.

Hinge-line straight, equalling or greater than the length of the shell.

Beaks acute, anterior, inclined forward, arching over the hinge in the left valve; less prominent in the right.

Ear short, limited by a sulcus and sinus which is deeper in the right valve. Wing large, triangular, defined only by the abrupt bending of the striæ; margin concave; extremity acute.

Test thin, marked by numerous, closely arranged, concentric lines of growth, and, at somewhat regular intervals, by sharp, projecting lamellose striæ; and corresponding with these, are regular concentric undulations, which are shown strongly on the cast, and but partially seen on the exterior surface. The striæ mark the wing in the same manner as the body, and are crowded on the ear.

Ligamental area narrow, marked by a single groove.

A large specimen measures 57 mm. in length, 51 mm. in height, hinge-line 58 mm.

This species resembles *L. Conradi*, but is broader, with comparatively greater height, less obliquity, and less extended posterior wing.

Formation and localities. In the shales of the Hamilton group at Bellona, Yates county, and on the shores of Cayuga and Canandaigua lakes, N. Y.

LEIOPTERIA RAFINESQUII.

PLATE XV, FIG. 11; PLATE XX, FIGS. 6, 7; AND PLATE LXXXVIII, FIGS. 27, 28.

Leiopteria Rafinesquii, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 15, fig. 11; pl. 20, figs. 6, 7. Jan., 1883.

SHELL of medium size, sub-rhomboidal; body rather narrow above, obliquely ovate; height equalling or greater than the length; margins regularly curved; the post-basal side extended; anterior side sometimes nearly straight for a short distance below the ear.

Left valve convex, gibbous on the umbo. Right valve less gibbous. The right valve supposed to belong to this species is convex on the umbo, and of moderate convexity below; the height is considerably greater than the length, and the body of the valve less distinctly defined than in the left valve.

Hinge-line straight; from the anterior side of the beak to the posterior extremity it is about equal to the length of the shell.

Beak of the left valve acute, directed forward, very prominent, situated at the anterior extremity of the shell. Umbonal region gibbous, subtending an acute angle.

Ear short, convex, obtuse, with a broad undefined vertical sulcus and shallow byssal sinus. Wing moderately large, flat; margin concave; extremity acute.

Test thin, marked by regular, concentric lines of growth, which are more crowded upon the cardinal expansions. The striæ are raised at intervals into strong, elevated lamellæ, which are conspicuous on the cast, and more crowded and prominent on the anterior side. The right valve referred to this species is marked by concentric wrinkles, which are well-preserved on the anterior side, with distant, elevated, lamellose striæ on the wing and the margin of the hinge.

Internal characters unknown. The ligamental area appears to be marked by a groove along the wing parallel to the hinge-line.

Three characteristic specimens have respectively the following dimensions: length 39, 34, and 25 mm., height 41, 38, and 26 mm., hinge-line 37, 39, and 26 mm. The right valve, mentioned above, is 23 mm. in length, 25 mm. in height, and 23 mm. along the hinge-line.

This species resembles the two preceding, but the form of body is more narrowly ovate, the obliquity appears to be intermediate between the two; the ear is less strongly defined; the wing is comparatively narrower, and less extended at the extremity.

Formation and localities. In the shales of the Hamilton group, on the shores at Skaneateles lake; at Bellona, Yates county, and Leonardsville, Madison county, N. Y.; a single specimen from the Corniferous limestone of Delaware, Ohio, has been referred to this species.

LEIOPTERIA SAYI, n. sp.

PLATE LXXXVIII, FIGS. 15–20.

SHELL above the medium size, sub-orbicular; body very broadly ovate, scarcely oblique; height greater than the length; margin nearly straight in front, thence regularly rounded.

Left valve very convex, gibbous in the umbonal region. Right valve smaller and less convex.

Hinge-line straight, longer than the length of the shell.

Beaks acute, situated near the anterior extremity of the hinge, prominent, inclined forward, arching over the hinge-line. Umbonal region ample, subtending a right angle.

Ear small, bending downward, defined by a broad, shallow sulcus. Byssal sinus narrow. Wing large, triangular, greatly extended along the hinge-line, defined by the retral bending of the striæ; margin concave; extremity acute. The wing of the right valve is very broad, flat, and much extended; not distinctly defined.

Surface marked by fine, closely arranged striæ of growth, with distant, elevated lamellæ, which are extensions of strong fascicles of striæ. These leave angular concentric folds and undulations in the casts. The striæ are strongly marked on the cardinal expansions and over the hinge-margin. In well-preserved specimens the undulations are stronger upon the middle of the valve, and less marked upon the anterior side and the wing. In the right valve they are much more regular and subdued.

Interior characters unknown. Ligamental area marked by a distinct groove parallel to the margin.

The largest specimen has a length of 50 mm., height 46 mm., hinge-line about 45 mm. A small specimen measures 26 mm. in length, 39 mm. in height, hinge-line imperfect. Another specimen is 26 mm. in length, 33 mm. in height, hinge-line 27 mm. A right valve is 33 mm. in length, height about the same, hinge-line 41 mm.

This form resembles, in general surface characters, the three preceding species, but differs by the more erect body and sub-orbicular form. In general aspect it resembles Glyptodesma, and the surface markings are not very different, though none of the specimens show the hinge characters of that genus.

The description has been drawn from specimens preserved in fine calcareous shale and in coarser arenaceous material, and the characters remain essentially the same in both.

In a single specimen from the arenaceous shales on the shore of Cayuga lake, at Norton's Landing, where the shell is partially exfoliated, the surface is marked by fine, concentric lines of growth, and more distant lamellose striæ, which are about twice as numerous as in the typical specimens. These give a gently undulating character to the surface of the cast of the left valve, instead of the abrupt angular folds of the typical specimens. In the right valve of the same specimen the striæ on the umbo are similar, but more closely arranged, and on the lower portion, in the cast, they exhibit the gentle undulations of the typical forms of the right valve.

Formation and localities. In shales of the Hamilton group, in Ontario county; Norton's Landing, Cayuga county; Bellona, Yates county, and in the coarse grits at Leonardsville, Madison county, N. Y.

LEIOPTERIA DEKAYI.

PLATE XIX, FIG. 1; PLATE XX, FIGS. 16-18; AND PLATE LXXXVIII, FIGS. 5-10.

Leiopteria Dekayi, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 19, fig. 1; pl. 20, figs. 16-18, (19 in error). Jan., 1883.

SHELL of medium size, sub-rhomboidal in general form; body narrowly ovate, oblique; length about equal to the height; anterior margin nearly vertical for one-third the length of the shell, thence broadly rounded over the basal margin and abruptly recurved at the post-basal extremity.

Left valve convex, gibbous on the umbo. Right valve smaller and less convex; the limitation of the wing not strongly defined.

Hinge-line straight, length a little less than the length of the shell measured from the anterior side of the beak to the extremity of the wing.

Beaks anterior, acute, prominent, inclined forward. Umbonal region gibbous above, regularly convex below, subtending an acute angle.

Ear bending downward, with a strong fold in the upper part, limited by a broad undefined sulcus and shallow byssal sinus. Wing triangular, flat, defined by the abrupt retral bending of the striæ and a depressed line along the post-cardinal slope; margin concave; extremity acute.

Test thin, marked by fine regular concentric striæ, which at unequal intervals are crowded into fascicles, giving an undulated aspect to the surface of the cast; in old specimens, more crowded on the anterior side and ear, and on the wing usually regular, sometimes becoming a little fasciculate on the margin.

This description of the surface is taken from casts or partial casts which preserve more or less the surface markings. In a few younger specimens from the shales, the surface shows fine regular striæ which gradually become fasciculate as the shell increases in size.

Ligamental area narrow, marked by fine striæ; below this area is a narrow oblique fold or lateral tooth.

The three specimens figured on plate xx, have respectively the following dimensions: length 37, 31, and 29 mm., height 37, 30, and 30 mm., hinge-line 31, 21, and 23 mm. A smaller specimen has length of 17 mm., height 16 mm., hinge-line 15 mm.

This species resembles in form *L. Conradi* and *L. Rafinesquii*, but there are some differences in shape and obliquity, and more decidedly in surface characters. The wing is not so much extended as in *L. Conradi*, the striæ are more abruptly recurved, and the post-cardinal slope is more strongly defined. There is a general resemblance with *L. Bigsbyi*, but the body and hinge-line are longer, the body narrowing more rapidly from the base, and the striæ are equal and uniform.

Formation and localities. In the soft shales of the Hamilton group; at Skaneateles and Cayuga lakes; and in the upper coarse beds and lower shales at Pratt's falls, Onondaga county; also at Schoharie, N. Y. It is widely distributed from the eastern to the central portion of the State.

LEIOPTERIA BIGSBYI.

PLATE XX, FIGS. 3, 11, 13-15; AND PLATE LXXXVIII, FIG. 23.

Leiopteria Bigsbyi, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 20, figs. 3, 11, 13–15. Jan., 1883.

SHELL larger than medium size, sub-rhomboidal; body ovate, oblique; height greater than the length; anterior margin nearly vertical for about half the height of the shell, thence regularly rounded along the base; posterior side moderately extended.

Left valve gibbous upon the umbo, less convex towards the base. Right valve gibbous on the umbo, depressed-convex below, shorter than the left valve.

Hinge-line straight, equalling or less than the length of the shell.

Beaks anterior, acute, prominent, rising above the hinge-line, inclined forward. Umbonal region prominent, subtending an angle of about 55°.

Ear short, bending moderately downward, with a strong fold at the upper side, limited by a broad, undefined sulcus. Byssal sinus shallow. Wing triangular, wide, nearly flat; margin concave; extremity acute. The wing of the right valve is less defined than in the left, and the byssal sinus is a little deeper.

Test thin; specimens partially exfoliated, or occurring in the condition of casts, show sharply elevated, lamellose, concentric striæ, which are very distinct on the wings, and crowded and somewhat fasciculate on the anterior side and ear. No intermediate finer striæ have been observed. In well-preserved specimens the sharp lamellæ have undulating margins.

Interior unknown. Ligamental area marked by a single groove.

A large specimen has a length of 43 mm., height 50 mm., hinge-line 37 mm. Another example has a length of 32 mm., height 33 mm., hinge-line 30 mm. In the younger shells the height is proportionally somewhat less than in the older ones.

This species, compared with the preceding, has a greater height of body and shorter hinge-line, and differs in the conspicuous, sharp, concentric lamellæ. In this species the concentric striæ do not produce the folds and undulations which are characteristic of *L. Rafinesquii* and *L. Greeni.*

Formation and localities. In shales of the Hamilton group at Pratt's falls, Onondaga county, and in the coarser beds at Schoharie, N. Y.

LEIOPTERIA MITCHELLI.

PLATE XX, FIG. 8; AND PLATE, LXXXVIII, FIG. 26.

Leiopteria Mitchelli, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 20, fig. 8. Jan., 1883.

SHELL large, sub-rhomboidal; body ovate, moderately oblique; height greater than the length; anterior margin nearly vertical from the ear for about half the height, then broadly curving to the post-basal side, thence more abruptly bending, making the posterior end slightly extended.

Left valve gibbous on the umbo, sloping from highly convex above to moderately convex below. Right valve unknown.

Hinge-line straight, equal to the length of the valve.

Beak anterior, acute, inclined forward, prominent. Umbonal region prominent, subtending an acute angle.

Ear short, limited by an undefined sulcus and shallow byssal sinus. Wing large, triangular, nearly flat, defined by the retral curving of the lamellose striæ; margin moderately concave; extremity abruptly acute.

Test thin, marked by regular concentric lines of growth, with distant, lamellose striæ, which are raised into thin, sharp elevations corresponding with the concentric folds or undulations of the shell. The cast shows only the undulations. On the anterior margin and wing, the lamellæ are closely crowded, producing a varicose appearance. They are more closely arranged upon the wing than on the valve, making a gentle retral curve and becoming very conspicuous on the hinge-margin.

Interior unknown. Ligamental area narrow.

A left valve has a length of 46 mm., height 49 mm., hinge-line about 47 mm.

This species, in general proportions, resembles *A. Bigsbyi;* it differs in the larger and more extended posterior end, with striæ nearly vertical or gently curving, except at the hinge margin; the body wider above, and the anterior basal margin less convex. With a single exception, the specimens of *L. Bigsbyi* occur in arenaceous beds, while this species is common both to the softer shales and in the coarser beds.

Formation and localities. In soft shales of the Hamilton group, from loose masses of rock at the south end of Seneca lake, and in the coarse grits, at Schoharie, N. Y.

LEIOPTERIA TROOSTI, n. sp.

PLATE LXXXVIII, FIGS. 12, 13.

SHELL above the medium size, sub-rhomboidal; body broadly ovate, moderately oblique; height somewhat greater than the length; anterior margin, from the wing to about half the height, nearly vertical, curving broadly around the base, and more abruptly rounded behind.

Left valve moderately convex, gibbous on the umbo. Right valve unknown.

Hinge-line straight, somewhat less than the length of the shell.

Beak anterior, acute, prominent, inclined forward, rising above the hinge. Umbonal region gibbous, abruptly limited on the anterior side by the sulcus, and on the posterior side sloping rapidly to the wing.

Wing large, flat, triangular, joining the body of the valve below the middle of the height, limited by the gently retral curve of the striæ; margin moderately concave; extremity acute or mucronate.

Surface marked by regular, equidistant, undulating, lamelliform, concentric expansions, which become crowded, finer, and to some extent less undulated on the wing, stronger and very much crowded on the anterior of the shell. The undulations extend forward in an abrupt curve, bending gently backward, and being thus opposite and slightly imbricating, they give an appearance of radiation.

Interior unknown.

The specimen described has a length of 35 mm., height 37 mm., and hinge-line about 29 mm.

In general aspect, this species resembles *Actinopteria Boydi*, but the body is much less oblique and wider below; the surface is without proper rays; the wing has only fine, crowded, concentric striæ; while in that species the wing is marked with strong radii and a few lines of growth.

These comparisons are made from similar casts of the interior of both species.

Formation and locality. In the coarse grits of the upper part of the Hamilton group, in the northern part of Schoharie county, N. Y.

LEIOPTERIA LEAI, n. sp.

PLATE LXXXVIII, FIGS. 24, 25.

SHELL small, sub-rhomboidal; body broadly ovate, very moderately oblique; height much greater than the length; margin regularly rounded from above the middle on the anterior side, to a similar point on the opposite side of the valve; post-basal margin slightly produced.

Left valve very convex; gibbous from below the middle to the umbo. Right valve unknown.

Hinge-line straight, less than the length of the shell.

Beak anterior, acute, rounded, inclined forward, prominent. Umbonal region gibbous, subtending an acute angle.

Ear short, directed downward, limited by an undefined sulcus, with scarcely any evidence of a byssal sinus. Wing comparatively small, flat, not strongly defined, joining the body of the shell above the middle of its height; margin concave; extremity abruptly acute.

Test marked by fine concentric striæ, which, at intervals, are crowded into fascicles upon the body of the shell, giving an undulating surface. On the wings they are closely and evenly arranged.

Interior unknown.

One specimen has a length of 20 mm., height 25 mm., and hinge-line about 17 mm. A small specimen has a length of 13 mm., height 15 mm., and hinge-line 12 mm.

This species is more prominent on the umbo and more convex below than any of the forms described in this group; the wing is shorter and smaller, with less extension along the posterior slope. A young shell referred to this species and in the same association has a body less abruptly defined on the posterior side.

Formation and locality. In the coarser grits of the Hamilton group, in the southern part of Schoharie county, N. Y.

LEIOPTERIA GABBI, n. sp.

PLATE LXXXVIII, FIG. 14.

SHELL small; body ovate, very slightly oblique; height considerably greater than the length; anterior margin nearly erect for half the height of the valve, and regularly curving to the post-basal margin, which is scarcely produced.

Valves sub-equally convex; the greatest convexity being a little above the middle in the left valve, and on the umbo of the right valve.

Hinge-line not extended, less than the length of the shell.

Beaks acute, prominent, directed forward, anterior to the middle of the shell. Umbonal region gibbous, subtending an acute angle.

Ear small, straight on the upper margin; marked by an oblique fold, and separated from the body by an abrupt sulcus and a well-defined byssal sinus. Wing small, triangular, joining the body of the shell below the middle of its height, defined by a change in the direction of the surface striæ; margin gently concave; extremity acute.

Test thin, marked by fine concentric striæ, and at regular intervals by stronger elevated striæ, which give to the macerated shell, and the cast of the interior, a regular banded surface. These stronger striæ are closely arranged on the anterior side and ear, while on the posterior side they preserve their equidistant character. The right valve is very distinctly marked by the elevated concentric striæ. In both valves there are radiating lines which apparently belong to the structure of the shell.

Interior unknown. Ligamental area narrow.

One specimen has a length of 13 mm., height 16 mm., hinge-line about 10 mm. Another example has a length of 12 mm., height 13 mm., and hinge-line about 11 mm.

The small size, erect ovate form, short hinge-line, the proportions of height and length, and the surface characters, distinguish this species from every other form here described.

Formation and localities. In the soft shales of the Hamilton group; shores of Canandaigua lake, and at Norton's Landing, Cayuga lake, N. Y.

LEIOPTERIA OWENI.

PLATE XX, FIG. 10.

Leiopteria Oweni, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 20, fig. 10. Jan., 1883.

SHELL quite large, sub-rhomboidal; body broadly ovate, oblique to the hinge-line; length greater than the height; margins rounded, produced posteriorly.

Left valve convex, umbo gibbous, beak elevated. Right valve concave below, flat above, becoming convex towards the beak, which is low and scarcely reaches the hinge.

Hinge-line straight, about equal to the length of the valve.

Beaks anterior, acute, directed forward.

Ear large, extended, defined by a broad sulcus and marked byssal sinus. Wing large, expanded; margin concave; extremity abruptly acute.

Test thin, marked by fine concentric striæ of growth, which on some parts of the surface are crowded into fascicles, producing ridges or undulations. These are somewhat regular over the whole of the left valve, and stronger on the anterior part; on the right valve they are without regularity. The right valve also shows radiating lines which appear to belong to the shell structure, and are quite conspicuous in partially exfoliated specimens. The striæ are crowded and lamellose on the anterior margin and adjacent to the byssal sinus; on the wing they are closely and evenly arranged.

Interior unknown.

One of the imperfect specimens described has an approximate length of 61 mm., height 55 mm., and hinge-line about 55 mm.; the measurement along the axis of the body, from the beak to the post-basal margin, is 75 mm.

The two specimens observed are crushed, and the characters of the left valve are very much obscured, while the right valve preserves more nearly its true proportions. It differs from the other species of this group in the concave form of the right valve. In surface markings it is very similar to *L. Sayi*, but the concave right valve is a very distinguishing feature. The shell is large and thin, and has suffered compression and distortion in the process of imbedding in the soft shales.

Formation and locality. In the soft shales of the Hamilton group, Canandaigua lake, Ontario county, N. Y.

LEIOPTERIA CHEMUNGENSIS.

PLATE XXII, FIGS. 17, 18.

Avicula Chemungensis, VANUXEM. Geolog. Surv. N. Y.: Rep. Third Dist., p. 182, fig. 49, No. 3. 1842.
Leiopteria nitida, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, figs. 17, 18. Jan., 1883.

SHELL of medium size or larger, rhomboid-ovate; body elongate-ovate, oblique at an angle of about 60° with the hinge-line; length equal to more than four-fifths of the height; anterior margin nearly vertical for about one-half the height of the shell and broadly rounded on the base; post-basal margin abruptly rounded.

Left valve convex, gibbous in the umbonal region. Right valve smaller, less gibbous.

Hinge-line straight, a little longer than the height of the shell.

Beaks sub-anterior, inclined forward, acute, prominent, arching over the hinge. Umbonal region narrow, prominent, subtending an acute angle.

Ear of left valve small, bending slightly downward, defined by a broad distinct sulcus; extremity rounded. Ear of right valve flat. Byssal sinus shallow and broad, deeper in the right valve. Wing broad-triangular, joining the body below the middle of the length, limited by the abrupt bending of the striæ; margin deeply concave in the middle; extremity produced and acute.

Surface, in a partial cast, marked by fine concentric striæ, which are crowded and lamellose on the ear, distinctly marked on the wings, and appearing on the body as distinct undulations: these in the perfect shell may have been sharp lamelliform striæ.

Interior unknown.

A specimen of the left valve has a length of 30 mm., height 35 mm., hinge-line 47 mm.; the body from beak to post-basal extremity measures 43 mm.

The specimen figured is the original of *Avicula Chemungensis*, VANUXEM. It resembles *L. Dekayi* of the Hamilton group, but differs in its longer hinge-line, larger wing, and more acute beak, while the body of the shell is narrower.

In the volume of Plates and Explanations this species was referred to *L. Dekayi* in the absence of the original specimen, which has since been compared and found to belong to the Chemung group.

Formation and locality. In a slaty sandstone of the Chemung group, eight miles north of Binghamton, N. Y.

LEIOPTERIA LINGUIFORMIS. n. sp.

PLATE LXXXVIII, FIG. 29.

SHELL above medium size, erect, sub-rhomboidal; body elongate-ovate, making an angle of about 60° with the hinge-line; length equal to three-fourths of the height; anterior margin nearly vertical from the byssal sinus to below the middle of the valve; basal margin broadly rounded; post-basal margin rapidly curving into the wing.

Left valve convex above, depressed-convex below. Right valve unknown.

Hinge-line straight, nearly equal to the length of the shell.

Beak acute, erect, prominent, rising above the hinge-line. Umbonal region convex, subtending an acute angle.

Ear small, triangular, bending slightly downward, limited by a well-defined byssal depression; margin nearly straight; extremity rounded. Byssal sinus shallow. Wing broad-triangular, joining the body below the middle of the post-cardinal slope, not strongly limited; margin concave; extremity acute.

Surface marked by concentric striæ which are strongly lamellose on the ear, the pallial margins and on the wing.

Ligamental area narrow, marked by two or three longitudinal grooves. Muscular impression oval, situated near the middle of the post-cardinal slope.

The specimen described has a length of 33 mm., height 42 mm., and hinge-line 32 mm.

This species differs from *L. Chemungensis* in its more erect form, and the ear is without the strong fold and marked sulcus of that species; the wing is also less extended and the margin less concave.

Formation and locality. In the Chemung group in the valley of Cayuta creek, Broome county, N. Y.

LEIOPTERIA TORREYI, n. sp.

PLATE XXII, FIGS. 6, 7; AND PLATE LXXXVIII, FIG. 11.

SHELL of medium size, rhomboidal, sub-falcate; body narrow-ovate, arcuate, oblique at an angle of less than 45° with the hinge; height equal to about two-thirds of the length; anterior and basal margins broadly curving from the byssal sinus; post-basal margin produced and abruptly recurved.

Left valve very convex, gibbous in the middle and above. Right valve unknown.

Hinge-line straight, about equal to the height of the valve.

Beak sub-anterior, directed forward, acute, prominent and arching over the hinge. Umbonal region narrow, ventricose, well-defined, subtending an acute angle.

Ear large, bending downward, marked by a strong oblique fold, limited by a broad, vertical byssal depression and shallow sinus; margin convex; extremity apparently obtuse. Wing joining the body above the posterior extremity, limited by the nearly vertical post-umbonal slope, which makes a more or less marked sulcus; margin concave; extremity produced, acute.

Surface marked by fine striæ of growth which are somewhat regularly lamellose on the body of the valve.

A left valve has a length of 29 mm., height 22 mm., hinge-line 21 mm.

This species differs from *L. Chemungensis* in its proportionally greater length, narrower umbo, more convex and oblique left valve, and shorter wing.

Formation and locality. In a sandstone and conglomerate of the Chemung group near Panama, N. Y.

LEPTODESMA, Hall.

The species arranged under the generic designation of Leptodesma present a very remarkable assemblage of forms, beginning (as here arranged) with those resembling Avicula and passing through various phases in form, proportions, etc., until the wing becomes nearly obsolete, the byssal sinus obscure, and the anterior end rounded, and the entire shell assuming the form of Mytilus or Modiola, Sanguinolites, Modiomorpha and allied genera. For convenience the species have been arranged into natural groups in the following order: *a*, *spinifera*; *b*, *umbonata*; *c*, *rostrata*; *d*, *patulata*; *e*, *arcoidea*; *f*, *mytiloidea*. These relations will be more fully explained under the generic description and discussions in the Introduction to this volume.

Section *a*, *spinifera*.

Leptodesma Marcellense.

PLATE XVII, FIG. 12.

Leptodesma Marcellense, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 17, fig. 12. Jan., 1883.

Shell small, sub-rhomboidal; body obliquely ovate; height about two-thirds the greatest length; margin regularly rounded, extended posteriorly and continuing in a direct line to the beak.

Left valve moderately convex. Right valve unknown.

Hinge-line straight, greatly extended posteriorly, reaching beyond the margin of the valve.

Beak obtuse, prominent, nearly erect, situated on the anterior third of the hinge. Umbonal region prominent, sloping abruptly on the posterior, not well defined on the anterior side.

Anterior end limited by a shallow, obscure sulcus; margin regularly rounded. Wing narrow-triangular, much extended along the hinge, terminating in a mucronate process; margin deeply and acutely sinuate.

Test thin, marked by fine, closely arranged, concentric striæ, which are more crowded anteriorly; these are crossed by extremely fine radii, which are chiefly confined to the shallow sulcus, anterior to the beak, and are also obscurely marked on the wing.

Ligamental area marked by two strong grooves. Two oblique linear depressions along the posterior slope indicate the probable existence of lateral teeth. Other characters of the interior, unknown.

The specimen has a length of 11 mm., height 7 mm., hinge-line 12 mm.

This species bears some resemblance to several species in the Chemung group, but it is comparatively narrower and more oblique.

Formation and locality. In the Marcellus shale, Bloomfield, Ontario county, N. Y.

LEPTODESMA ROGERSI.

PLATE XXI, FIGS. 1-9.

Leptodesma Rogersi, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 1-9. Jan., 1883.

SHELL of small or medium size, sub-rhomboidal; body ovate, very oblique; length greater than the height; anterior and basal margins broadly rounded; posterior margin extended and abruptly recurved.

Valves equally convex above. Right valve somewhat depressed below, comparatively higher than the left.

Hinge-line straight, longer than the length of the shell.

Beaks sub-anterior, obtuse, nearly erect, prominent. Umbonal region gibbous, oblique.

The anterior extremity is scarcely alate or auriculate, consisting of a rounded extension, straight above and slightly sinuate at the base. Wing comparatively large, triangular, joining the body of the valve near the posterior extremity, defined by the crowding and curving of the concentric striæ; margin nearly straight for five-sixths of its extent, then acutely recurving; extremity prolonged into a mucronate spine which extends beyond the posterior limit of the valve. In the right valve the wing is less deeply sinuate.

Test thin, marked by closely arranged concentric striæ, which at irregular intervals are crowded into fascicles, producing a gently undulated surface. On the wing the striæ are closely arranged, and just below the hinge-line are turned backward along the spiniform extension of the wing.

Interior unknown. Ligamental area narrow, having several fine grooves parallel to the hinge.

One specimen has a length from beak to base of 24 mm., height 15 mm., hinge-line about 20 mm. The corresponding right valve has a length of 20 mm., height 15 mm., hinge-line 26 mm. The largest specimen observed has a length of 32 mm., height 21 mm., hinge-line, to the origin of the spine, 20 mm. Small specimens are often less than 10 mm. in length and height.

This species, occurring abundantly in the Hamilton group, closely resembles *Avicula spinigera* of Conrad, from the Chemung group. In the comparison of large numbers of specimens, the differences are so slight that specific distinction is not always apparent. The Chemung forms are usually more oblique, but this is not a constant character; the wing is smaller and less extended along the posterior slope; the right valve is narrower and more oblique, and the sinus in the margin of the wing is narrower and deeper than in the right valve of the Hamilton form.

Formation and localities. In the shales of the Hamilton group at Norwich, Chenango county; Middleville, Schoharie county, and Leonardsville, Madison county, N. Y.

Leptodesma spinigerum.

PLATE XXI, FIGS. 10-13; AND PLATE LXXXIX, FIG. 1.

Avicula spinigera, Conrad. Jour. Acad. Nat. Sci., Phila., vol. 8, p. 237, pl. 12, fig. 3. 1842.
Pteronites spinigerus (Conrad), S. A. Miller. Cat. Amer. Pal Foss., p. 202. 1877.
Leptodesma spinigerum (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 10-13. Jan., 1883.

Shell of medium size, sub-rhomboidal; body ovate, oblique to the hinge at an angle of about 45°; length one-third greater than the height; ante-byssal margin truncate at the extremity, curving below into the sinus; basal margin rounded, somewhat abruptly recurved posteriorly.

Left valve regularly convex below, gibbous above the middle. Right valve depressed-convex below and abruptly gibbous above.

Hinge-line straight, (and including the spine) equal to or greater than the length of the shell.

Beaks sub-anterior, prominent. Umbonal region abruptly gibbous, subtending an acute angle.

Anterior end short, defined by the oblique byssal depression which extends to more than one-third the length of the valve below the beak; extremity obtusely angular. Wing not large, joining the body nearly at the posterior third; margin oblique below, acutely recurved above, the greatest concavity being just below the cardinal extension; extremity produced into a long spiniform process.

Test thin, marked at irregular intervals by strong concentric lamellæ, with intermediate fine striæ. The lamellæ are stronger on the anterior side and obscure on the wing. The casts are often nearly smooth.

Interior unknown.

A specimen of medium size has a length of 29 mm., height 20 mm., hinge-line to base of spine, 12 mm. A smaller specimen has a length of 20 mm., height 14 mm., hinge-line, to base of spine, 12 mm.

This species closely resembles *L. Rogersi*, but is distinguished by the oblique and more extended byssal depression, shorter wing, and more rounded basal margin.

Formation and localities. In shales of the Chemung group, on the Chemung river above Elmira, and along the Blossburg railroad near Painted Post, N. Y.

LEPTODESMA LONGISPINUM.

PLATE XXI, FIGS. 14, 17–19; AND PLATE LXXXIX, FIGS. 2-4.

Avicula longispina, HALL. Geolog. Surv. N. Y.: Rep. Fourth Dist., p. 262, fig. 3. 1843.
Pterinea longispina (HALL), S. A. MILLER. Cat. Amer. Pal. Foss. 1877.
Leptodesma longispinum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 14, 17–19. Jan., 1883.

SHELL above the medium size, sub-rhomboidal; body elongate-ovate, very oblique; length greater than the height, often nearly double; margin from the byssal sinus to beyond the base broadly rounded; posterior margin extended and abruptly recurved.

Valves, in young specimens, sub-equally convex; in older specimens the right valves are somewhat less convex.

Hinge-line straight; length equalling or greater than the length of the valve.

Beaks anterior, prominent, obtuse, nearly erect, arching over the hinge-line. Umbonal region gibbous, subtending an acute angle.

Anterior extension scarcely auriculate, rounded in front, straight above. Wing small, very narrow-triangular; margin deeply sinuate, the bottom of the sinus being close beneath the hinge-line; extremity produced into an elongate spine.

Test thin, marked by fine, irregular, concentric striæ of growth, which are abruptly recurved on the post-cardinal slope, and extend along the margin for nearly half the length of the body before recurving into the wing. The striæ are more elevated and crowded on the anterior side.

The original specimen of this species has a greatest length from beak to base of 42 mm., height 24 mm., hinge-line about 38 mm. A small right valve has a length of 22 mm., height 12 mm., hinge-line 24 mm.

This species resembles *L. Rogersi*, but the shell attains a larger size; the body is more oblique to the hinge-line, and the posterior extremity more abruptly recurved; the wing is smaller and not extending so far down the body of the valve, the sinus is narrower with the deepest portion just beneath the hinge; the spine is stronger and more distinctly defined; the right and left valves are the same in form; the sinus in the wing of the right valve is not so deep as in the left valve, but much deeper than in the right valve of that species.

The original specimen is illustrated in figure 14 of plate xxi, and figures 17, 18, 19 are right valves occurring in the same beds.

This form is associated with *Avicula spinigera* of CONRAD, which is a smaller shell, less oblique, narrower, and with a more angular anterior extremity.

Formation and localities. In the Chemung group, at Painted Post, Steuben county, between Corning and Elmira, and at Chemung Narrows, N. Y.

LEPTODESMA SHUMARDI, n. sp,

PLATE LXXXIX, FIGS. 5, 6.

SHELL of medium size, sub-rhomboidal; body narrow, very obliquely-ovate; length somewhat less than twice the height; margin very broadly curving from the anterior extremity to the base; basal margin rounded and abruptly recurved at the post-basal extremity.

Left valve quite convex; the greatest convexity about one-third the length of the valve below the apex. Right valve unknown.

Hinge-line straight; length about equal to the height of the shell.

Beak sub-anterior, obtuse, prominent and arching over the hinge-line. Umbonal region gibbous, subtending an acute angle.

Anterior extremity short, acute, straight above, oblique below. Wing small, narrow-triangular, extending to a point below the middle of the length of the shell; margin concave; extremity acute, probably spiniform.

Test thin, marked by lamellose, often fasciculate striæ, which are more crowded on the anterior side and byssal depression, and more regular and distinct on the wing.

Interior unknown.

Three specimens of left valves have respectively the following dimensions: length 42, 40 and 36 mm., height 24, 27 and 24 mm., and hinge-line about 26, 24 and 24 mm.

This species differs from *L. longispinum* in the wider and somewhat less oblique body, with more regularly rounded posterior extremity; the sinus in the wing is less acute and farther below the cardinal line, also in the absence of the strong posterior spine of that species.

Formation and locality. In the Chemung group, near Elmira, N. Y.

LEPTODESMA ROBUSTUM.

PLATE XXI, FIGS. 15, 16, 20; AND PLATE LXXXIX, FIG. 8.

Leptodesma robustum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 15, 16, 20. Jan., 1883.

SHELL large, sub-rhomboidal; body obliquely ovate; length much greater than the height; ante-byssal margin rounded; straight below, or scarcely impressed by the sinus, making a broad curve around the base to the post-basal extremity and thence abruptly recurving toward the beak.

Left valve gibbous above, regularly convex below the middle; the greatest convexity about one-third the length of the valve from the beak. Right valve moderately convex in the middle, flat below and scarcely gibbous on the umbo.

Hinge-line straight, about equal to the length of the shell.

Beaks nearly anterior, obtuse, sub-erect, very prominent, rising above the hinge-line. Umbonal region gibbous, prominent, abruptly elevated along the post-umbonal side for more than half the length of the shell, then merged in the general convexity; on the anterior side obscurely limited by a broad undefined depression. Umbonal angle acute.

Anterior extremity scarcely auriculate. Wing small, narrow-triangular, extending about half the length of the valve, defined by the curving of the striæ; margin strongly concave, the deepest concavity just below the hinge; cardinal margin thickened and extended into a strong spine. In the right valve the wing is larger and broader, and the sinus less deep; the anterior extremity corresponds with that of the left valve.

Test moderately thick, marked by fine concentric striæ which become more numerous and fasciculate at irregular intervals, producing a slightly undulated surface, crowded and lamellose on the anterior.

Interior unknown.

A specimen of a left valve has a length, from beak to base, of 43 mm., height 29 mm., and hinge-line to the base of the spine 25 mm. A right valve, referred to this species, has a length of 32 mm., height 27 mm., and hinge-line, exclusive of the spine, 31 mm.

This species is larger and more robust than *L. longispinum;* the body is wider, less oblique, and less abruptly recurving at the post-basal extremity; the wing is larger and the greatest depth of the sinus not quite so near the cardinal line; the striæ do not recurve so abruptly forward on the posterior slope; the right valve is proportionally higher; the wing is less deeply sinuate, and the spiniform extension is shorter.

Compared with *L. Mortoni*, the body of the shell is less oblique and more expanded, while the wing is much smaller and the sinus nearer the hinge-line.

Formation and locality. In the middle portion of the Chemung group at Painted Post, Steuben county, N. Y.

LEPTODESMA AGASSIZI, n. sp.

PLATE LXXXIX, FIGS. 17-19.

SHELL of medium size, sub-rhomboidal; body broadly ovate, oblique to the hinge-line at an angle of from 50° to 55°; length nearly one-third greater than the height; anterior margin broadly rounded below the byssal sinus; ventral margin regularly curved; more abruptly curved at the post-basal extremity.

Left valve moderately convex below, more convex above and gibbous on the umbo. Right valve less convex.

Hinge-line straight, about equal to the height of the valve.

Beaks sub-anterior, scarcely directed forward, prominent, rising a little above the hinge-line. Umbonal region moderately gibbous, subtending an acute angle.

Anterior end large, obtuse, truncate above and curving below into the byssal sinus, limited by an oblique depression which reaches to near the middle of the length of the valve. Wing small, joining the body below the middle; margin oblique below and abruptly concave just beneath the cardinal line, recurving and produced into a short spiniform extension. The right valve is less convex, the wing larger and more extended along the posterior slope.

Test thin, marked by fine, distant, lamellose striæ with intermediate finer lines. The stronger striæ are more conspicuous on the anterior. The partial casts are nearly smooth.

Interior unknown.

One specimen has a length of 29 mm., height 23 mm., hinge, to base of spine, 15 mm. Another example has a length of 26 mm., height 19 mm., hinge, to base of spine, 15 mm.

This species bears a general resemblance to *L. spinigerum*, with which it is sometimes associated, but the body is more erect and much wider below; the wing is somewhat wider, the spine shorter, and the striæ less strongly marked.

Formation and locality. In the middle portion of the Chemung group, on the Chemung river, between Elmira and Waverly, N. Y.

LEPTODESMA PROTEXTUM.

PLATE XXI, FIGS. 22, 23.

Avicula protexta, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 238, pl. 12, fig. 6. 1842.
Pterinea protexta (CONRAD), S. A. MILLER. Cat. Amer. Pal. Foss., p. 202. 1877.
Leptodesma protextum (CONRAD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 22, 23. Jan., 1883.

SHELL small, sub-rhomboidal; body elongate-ovate, very oblique; length nearly twice as great as the height; anterior margin below the byssal sinus, oblique; base broadly rounded and abruptly recurved on the post-basal extremity.

Valves sub-equally convex; the greatest convexity is above the middle of the length, becoming less toward the posterior side, which is somewhat depressed. The right valve is apparently a little smaller than the left.

Hinge-line straight, about equal to the length of the shell.

Beaks near the anterior end of the valve obtuse, rounded, prominent, inclined forward. Umbonal region narrow, gibbous for a short space below the hinge, subtending an acute angle.

Anterior end scarcely auriculate, abruptly rounded in the left valve, pointed in the right valve, limited by a broad, undefined depression, which is less marked in the right valve. Byssal sinus shallow. Wing narrow-triangular, joining the body near the posterior extremity of the valve, defined by the direction of the striæ; margin deeply concave, the greatest concavity just beneath the hinge-line; extremity produced into a sharp spine which extends nearly as far as the posterior margin of the shell.

Test thin, marked by concentric striæ of growth, which are crowded into fascicles at irregular intervals, giving a somewhat wrinkled or undulating surface. On the anterior side the striæ are crowded and lamellose, while they are quite regular and closely arranged over the wing. On the external shell the striæ are elevated into regular, equidistant lamellæ. In the exfoliated shell, or partial casts, the surface presents obscure or obsolescent radii which appear to belong to the intimate shell-structure, and which are not shown on well-preserved specimens.

Interior unknown.

The largest specimen observed has a length of 26 mm., height 13 mm., hinge-line 20 mm. A similar right valve has a length of 23 mm., height 10 mm., hinge-line 16 mm. The specimens are usually smaller than those figured.

This species, in form of body and in the concentric striæ, resembles *L. longispinum;* but the anterior extremity (especially in the right valve) is narrower, the wing is extended farther down the body of the valve, and the spine is less produced.

This shell in its usual condition of preservation (that is, having the spiniform process of the wing broken off, or the wing partially covered) presents the characters described by Mr. Conrad, although not illustrated in his figure. A specimen of this species is labelled in the hand writing of Mr. Conrad, *Avicula protexta,* and therefore the name is retained.

Formation and localities. In the Chemung group at Chemung Narrows, N. Y., and Tioga county, Pa.

LEPTODESMA BECKI.

PLATE XXII, FIGS. 3-5.

Leptodesma Becki, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, figs. 3-5 (and figs. 6 and 7 in error). Jan., 1883.

SHELL of medium size, sub-rhomboidal; body oblique, narrowly ovate in the left valve; length more than one-third greater than the height; anterior margin oblique, extending in nearly a direct line into the broadly rounded basal margin; post-basal margin produced, not abruptly recurved into the wing.

Left valve gibbous except in the lower part. Right valve less convex.

Hinge-line straight, less than the length of the shell, and greater than the height.

Beaks at about the anterior third of the hinge-line, obtuse, directed forward and arching over the hinge. Umbonal region gibbous, scarcely defined anteriorly, but well-marked posteriorly by the abrupt slope of the side. Umbonal angle acute.

Anterior end truncate, acute at the extremity. Wing of medium size, not distinctly limited, joining the body nearly at the posterior extremity; margin concave; extremity produced into a short spine. The right valve is proportionally higher, the body less distinctly defined, and the wing larger.

Test thin, marked by concentric striæ, which are crowded and somewhat lamellose in front, and closely and evenly arranged on the wing. The hinge-line has a single narrow groove.

A left valve has a length of 28 mm., height 17 mm., hinge-line about 22 mm. A detached right valve has a length of 29 mm., height 20 mm., hinge-line 30 mm.

This species resembles *L. robustum* in general expression and in the sinus of the wing, but the body is narrower, more regularly convex, the base less expanded, and the basal margin and the striæ along the posterior slope are not so abruptly recurved.

Formation and localities. In the Chemung group, near Corning, Chemung county, and Portville, Alleghany county, N. Y.

LEPTODESMA DISPARILE.

PLATE XXV, FIGS. 2-4; AND PLATE LXXXIX, FIGS. 23, 24.

Leptodesma disparile, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, figs. 2-4. Jan., 1883.

SHELL of small or medium size, sub-rhomboidal; body ovate, oblique to the hinge at about 45°; length more than one-third greater than the height in the left valve; ante-byssal margin oblique, gently curving into the sinus; basal and posterior margins regularly rounded.

Left valve convex below, gibbous above. Right valve flat or concave below, depressed-convex in the middle, and gibbous on the umbo.

Hinge-line straight, greater than the length of the shell.

Beak sub-anterior, prominent, rising above the hinge-line, directed slightly forward. Umbonal region gibbous, subtending an acute angle.

Anterior end large, somewhat produced, limited by a nearly vertical byssal depression; extremity obtusely angular. Wing somewhat large, joining the body near the posterior extremity; margin oblique below, concave above the middle, and produced into an elongate spiniform process. The right valve is smaller, the wing more extended and less defined, while the anterior end is large and well defined by the byssal sinus and sulcus.

Test marked by concentric, lamellose ridges with intermediate finer lines of growth; the lamellæ are sometimes more distinct on the right valve.

Interior unknown.

A left valve has a length of 28 mm., height 20 mm., hinge-line more than 30 mm. A right valve has a length of 30 mm., height 18 mm., hinge-line 33 mm.

This species is distinguished from *L. Rogersi* and *L. spinigerum* by the large anterior end, narrower umbo, more extended wing, with less deeply sinuate margin, less convex right valve, and the regular concentric lamellose ridges of the surface.

Formation and localities. In sandstones of the Upper Chemung group, McKean county, Pa.; and Farmer's Valley, Cattaraugus county, N. Y.

LEPTODESMA SOCIALE.

PLATE XXI, FIGS. 24–28 (33, 34 ?).

Leptodesma sociale, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 24–28 (33, 34 ?). Jan., 1883.

SHELL small, sub-rhomboidal; body broad-ovate, oblique; length greater than the height; anterior margin nearly straight and quite oblique; base regularly rounded; post-basal side somewhat extended and abruptly recurved.

Left valve convex, gibbous in the upper part, more convex than the right valve, which is moderately convex above and depressed-convex or flat below.

Hinge-line straight, sometimes greater than the length of the shell.

Beaks at about the anterior third of the hinge-line; the left beak prominent, obtuse; the right beak less conspicuous. Umbonal angle acute.

Anterior extremity sub-auriculate, straight above, slightly extended. Wing triangular, joining the body of the valve below the middle of its length (measured from hinge to base); margin regularly concave; extremity produced into a spine, which, in perfect specimens, reaches beyond the margin of the valve. In the right valve the wing is less distinctly defined, and the sinus not so deeply concave.

Surface marked by fine concentric striæ, which at somewhat regular intervals are elevated into sharp, conspicuous lamellæ, or sometimes into fascicles of striæ producing elevations. These become crowded and irregular on the anterior of the valve, and are very regular and uniform on the wing and on the right valve.

Interior unknown.

A specimen of a left valve has a length of 10 mm., height 7.5 mm., hinge-line about 10 mm. A similar specimen has a length of 11 mm., height 6.5 mm., and hinge-line about 11 mm. A right valve has a length of 9 mm., height 6 mm., hinge-line about 8 mm. Another one has a length of 16 mm., height 11 mm., hinge-line about 16 mm.

This is a small and abundant species, often occurring in great numbers on the surfaces of shaly layers. It is distinguished by its form and the regular lamellose appearance of the surface.

Formation and localities. In the shales of the Chemung group at Connewango, Cattaraugus county; Nanticoke Springs, Broome county, and south of Ithaca, N. Y.

Leptodesma potens.

PLATE XXI, FIGS. 21, 30; PLATE XXII, FIGS. 11, 12, 19, (20?) 21; AND PLATE LXXXIX, FIG. 7.

Leptodesma potens, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 21, 30; pl. 22, figs. 11, 12, 19, 21. Jan., 1883.

Shell large, sub-rhomboidal; body ovate, oblique, broad below; length more than one-third greater than the height; ante-byssal margin sub-truncate, erect, oblique below; basal margin broadly curving; posterior margin broad, extended and abruptly recurving at the upper extremity.

Left valve convex, gibbous above; the greatest convexity at one-third the height of the shell from the beak. Right valve almost equally convex, more abruptly gibbous on the umbo, and comparatively shorter and wider.

Hinge-line straight, about equal to the length of the shell.

Beak sub-anterior, obtuse, erect, prominent, arching over the hinge. Umbonal region gibbous, very prominent, limited anteriorly by a shallow depression extending from a point anterior to the beak to the margin at one-third the height of the shell below the hinge-line; posteriorly limited by the abrupt post-cardinal slope. Umbonal angle acute.

Anterior extremity extended and angular. Wing large, triangular, joining the body near the posterior extremity, distinctly limited; margin broadly sinuate; extremity produced into a strong spine (the extent of which is unknown).

Surface marked by strong concentric lines of growth, which are crowded into small fascicles at irregular intervals on the body of the shell, and become lamellose expansions on the anterior. On the wing they appear as sharp equidistant lamellæ. Casts of the interior show the concentric striæ in a subdued condition.

Interior unknown.

The largest left valve observed has a length, measured from beak to base, of 62 mm., height 46 mm., hinge-line, exclusive of the spine, 58 mm. A smaller specimen has a length of 57 mm., height 39 mm., hinge-line, to base of spine, 58 mm. A right valve referred to this species has a length of 36 mm., height 28 mm., and hinge-line, to base of spine, 35 mm.

This species more nearly resembles *L. robustum* than any of the forms here described; but it is larger, the wing proportionally larger and distinctly limited, and the sinus of the wing more central. The right valve is also more convex and the wing more deeply sinuate. It occurs in the upper members of the Chemung group, associated with *Spirifera Verueuili*, while *L. robustum* is found only in the middle of the series.

It is a larger and more robust shell than *L. Mortoni*, and the right valves are very unlike.

Formation and localities. In the Upper Chemung group at Olean, Portville, Cassadaga lake, and in loose specimens collected near Panama, N. Y.

LEPTODESMA POTENS, var. JUVENS.

PLATE XXII, FIG. 16.

Leptodesma potens, var. juvens, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 16. Jan., 1883.

SHELL small, rhomboidal; body ovate, oblique; the greatest length more than once and a half the height; anterior margin oblique, very broadly curving below; post-basal extremity rounded and abruptly recurved.

Left valve convex below, very gibbous and ventricose in the middle and above. Right valve unknown.

Hinge-line straight, less than the length of the shell.

Beak obtuse, situated at the anterior third of the hinge-line, prominent, arching over the hinge-line and inclined slightly forward. Umbonal region ventricose, obscurely limited anteriorly by an undefined depression, and on the posterior side by the abrupt and almost vertical post-umbonal slope. Umbonal angle acute.

Anterior end short, triangular; extremity acute. Wing broad-triangular, joining the body of the shell near the posterior end; margin regularly concave; extremity acute.

Test thin, marked by extremely fine, regular concentric striæ, which are crowded into fascicles on the anterior end.

Interior unknown.

The specimen described has a greatest length of 25 mm., height 15 mm., hinge-line 22 mm.

This shell resembles *L. potens*, but it is apparently more extended and acute in front, sub-truncate on the posterior end; the wing joins the body near the posterior extremity, and its margin is less deeply sinuate than *L. potens*. These variations appear in comparison with the older individuals of that species and cannot be taken as positive evidence of specific difference, while at the same time their common characters may be insufficient to unite them.

Formation and locality. In the Chemung group at East Randolph, Cattaraugus county, N. Y.

LEPTODESMA MORTONI.

PLATE XXI, FIGS. 29, 31, 32; AND PLATE LXXXIX, FIGS. 9-11.

Leptodesma Mortoni, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 29, 31, 32 (pl. 22, fig. 20 in error). Jan., 1883.

SHELL above the medium size, sub-rhomboidal; body elongate sub-ovate, very oblique; length more than one-half greater than the height; ventral margin broadly curving to the base; the posterior margin extended and abruptly recurved.

Left valve convex, gibbous above. Right valve depressed-convex below, and abruptly gibbous at the umbo.

Hinge-line straight; length less than the length of the shell.

Beaks sub-anterior, obtuse, erect, prominent, arching over the cardinal line. Umbonal region gibbous and gradually sloping down to the general convexity, abruptly limited on the posterior side, subtending an acute angle.

Anterior end extended, acute and nasute. Wing large, triangular, slightly convex, joining the body of the shell more than two-thirds of the length below the beak; margin symmetrically concave; extremity produced and very acute. In the right valve the anterior end is broad and flat; the wing is large, with no defined limit between it and the body of the valve.

Surface marked by elevated concentric striæ which, at irregular intervals are fasciculate, producing undulations on the surface. This character is often marked on the front of the shell where the fascicles are composed of three or four distinct striæ.

Interior unknown.

A specimen of the left valve has a length, measured from beak to base, of 44 mm., height 30 mm., hinge-line about 38 mm. Another example has a length of 45 mm., height 25 mm., hinge-line 32 mm. A right valve measures 43 mm. in extreme length, height 30 mm., hinge-line about 34 mm.

This species bears some resemblance to *L. robustum*, but the body is more oblique and not so broad below; the anterior extremity is acute; the wing larger, more extended along the valve and very symmetrically concave on the margin. The form of the shell is very similar to *L. longispinum*, but differs by its larger wing, the broader sinus and more regularly rounded posterior extremity, and in the latter respect it resembles *L. Shumardi*, while it is otherwise very different.

Formation and localities. In the Chemung group at Portville and Little Genesee, Alleghany county, N. Y.

LEPTODESMA BILLINGSI, n. sp.

PLATE LXXXIX, FIGS. 12-15.

SHELL large, sub-rhomboidal; body elongate-ovate, or sub-cylindrical, very oblique; length about twice the height; ante-byssal margin rounded, becoming straight or slightly concave at the sinus; ventral margin broadly curving; posterior margin extended, acutely recurved at the post-basal extremity.

Left valve gibbous on the umbo, convex below. Right valve unknown.

Hinge-line straight; length, including the spine, nearly equal to the length of the valve.

Beak sub-anterior, obtuse, slightly oblique, prominent. Umbonal region somewhat gibbous, subtending an acute angle.

Anterior end limited by a shallow byssal depression, acute and nasute at the extremity. Wing long, narrow-triangular, extending below the middle of the valve; margin sinuate; extremity produced into a spine.

Test thin, marked by fine concentric striæ which are abruptly arched on the posterior slope, regular upon the wing, and crowded into fine irregular fascicles which are conspicuous on the anterior. Some specimens show sharp, elevated, lamellose striæ at equal distances on the surface of the body. The surface characters vary with the different states of exfoliation and maceration.

The largest specimen observed has a greatest length, from beak to base, of 57 mm., height 36 mm., hinge-line, to base of spine, 35 mm. A small example of the left valve has a length of 34 mm., height 18 mm., and hinge-line about 35 mm.

This species is more elongate and oblique than *L. longispinum*, the wing extends farther down along the posterior slope, and the anterior extremity is fuller and more acute.

Formation and localities. In the Chemung group at Panama, N. Y. Other specimens from near Elmira, N. Y., and Mansfield, Tioga county, Pa., are referred to this species with reservation.

LEPTODESMA MATHERI.

PLATE XXII, FIGS. 8, 9, 10; AND PLATE LXXXIX, FIG. 25.

Leptodesma Matheri, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, figs. 8–10. Jan., 1883.

SHELL of medium size, rhomboidal; body ovate, oblique at an angle of 45° with the hinge-line; length about one-half greater than the height; ante-byssal margin vertical in front, joining the broad curvature of the basal margin; posterior margin produced and abruptly recurved.

Left valve moderately convex below, scarcely gibbous above. Right valve shorter and less convex.

Hinge-line straight; length much less than the length of the valve, but nearly equal to the height.

Beaks at about the anterior third of the hinge, obtuse, directed slightly forward, not very prominent. Umbonal region moderately gibbous, subtending an acute angle.

Anterior end produced, flattened, acute at the extremity. Wing of moderate dimensions, extending nearly to the posterior extremity; margin gently concave; extremity produced and acute.

Test thin, marked by fine concentric striæ which are fasciculate on the body of the shell, producing an undulated appearance. The striæ are sub-lamellose on the anterior and regular over the wing.

Interior unknown.

A left valve has a length of 35 mm., height 23 mm., and hinge-line about 28 mm. A similar right valve has a length of 29 mm., and height 20 mm.

This species differs from *L. robustum* in its comparatively larger wing, without distinct sinus in the margin, and the more produced anterior end. It resembles *L. potens*, but differs in its more produced anterior end, less gibbous body, and more abruptly recurved posterior margin.

Formation and locality. In the upper beds of the Chemung group, near Bradford, McKean county, Pa.

LEPTODESMA STEPHANI, n. sp.

PLATE LXXXIX, FIGS. 20-22.

SHELL above the medium size, sub-rhomboidal; body ovate, straight on the post-umbonal slope, oblique at an angle of from 30° to 40° with the hinge-line; height about five-eighths of the length; ante-byssal margin vertically truncate above, curving below into the sinus; basal margin broadly rounded, abruptly recurved at the post-basal extremity.

Left valve convex, somewhat gibbous above. Right valve depressed-convex below and abruptly gibbous at the umbo.

Hinge-line straight, equal to about five-sixths the length of the valve.

Beaks sub-anterior, directed slightly forward, obtuse, prominent, rising a little above the cardinal line. Umbonal region regularly gibbous, subtending an acute angle.

Anterior end large, short, defined by a nearly vertical byssal depression, which reaches the margin about one-third the length of the valve from the anterior extremity, which is abruptly rounded or truncate. Wing joining the body at less than one-fourth the length of the valve from the posterior extremity; margin very oblique below, deeply concave above; the greatest depth of the concavity is above the middle, whence the margin is abruptly recurved and produced into a spiniform extension.

Test of moderate thickness, marked by nearly equidistant lamellose concentric striæ, with intermediate finer striæ of growth. The lamellose striæ are subdued upon the wing, and very strong and irregular on the anterior side.

Interior unknown.

A large specimen of this species has a length of 43 mm., height 25 mm., and hinge-line about 33 mm. A somewhat smaller example has a length of 37 mm., height 25 mm., and hinge-line 30 mm. A right valve measures 33 mm. in length, 24 mm. in height, and hinge-line 28 mm.

This species resembles *L. Matheri*, with which it is associated, but differs in its greater obliquity, more elongate outline, more extended and flatter wing, which is more deeply concave on the margin and with the extremity more produced; the anterior extremity is also larger and apparently not produced. The right valves of the two species are very unlike.

Formation and localities. In the Upper Chemung group at Bradford, Pa., and doubtfully occurring near Elmira, N. Y.

LEPTODESMA LEPIDUM.

PLATE XXI, FIG. 40; AND PLATE LXXXIX, FIG. 16.

Leptodesma lepidum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, fig. 40. Jan., 1883.

SHELL of medium size, narrow, sub-rhomboidal; body narrowly ovate, somewhat straight on the posterior slope, oblique at an angle of about 35° with the hinge-line; length less than twice the height; margin very oblique anteriorly, curving into a marked byssal sinus; base broadly rounded to the posterior extremity, which is abruptly recurved.

Left valve regularly convex below, gibbous above. Right valve very depressed-convex, nearly flat below, moderately convex on the umbo, considerably smaller than the left.

Hinge-line straight; length more than two-thirds the greatest length of the shell.

Beaks sub-anterior, directed forward, prominent in the left valve, depressed in the right valve. Umbonal region narrow and abruptly gibbous in the left valve; depressed and scarcely defined in the right. Umbonal angle about 30°.

Anterior end small, acute at the extremity, limited by a distinct vertical byssal depression. Wing narrow-triangular, joining the body at about one-fourth the length from the posterior extremity; margin deeply concave, abruptly recurved along the cardinal line, and extended into a spiniform process. In the right valve the wing is scarcely defined.

Test marked by very fine concentric striæ, which are regular upon the body and wing, and crowded and fasciculate on the anterior. In the right valve the striæ are more distant and more even in their character.

Interior unknown.

A left valve of medium size has a length of 41 mm., height 22 mm., length of cardinal line about 35 mm.

This species differs from *L. Hector* in its greater obliquity, broader body below, more produced and abruptly recurved post-basal extremity, deeper and broader byssal depression, more produced anterior end, and narrower and more deeply sinuate wing, with a more extended extremity.

Formation and localities. In the central portion of the Chemung group at Philipsburg, Alleghany county, N. Y., and below the conglomerate (same position) in Sullivan township, Tioga county, Pa.

LEPTODESMA CURVATUM.

PLATE XXV, FIG. 5.

Leptodesma curvatum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl 25, fig. 5. Jan., 1883.

SHELL above the medium size, rhomboidal; body ovate, sub-arcuate above, oblique at an angle of nearly 30° with the hinge-line; length and height as 7 to 4; ante-byssal margin oblique above, curving into a long, shallow sinus; basal and posterior margins forming a broad, continuous curve, and abruptly recurving at the post-basal extremity.

Left valve regularly convex below, gibbous above the middle. Right valve unknown.

Hinge-line straight; length about equal to the length of the valve, but not fully seen, as the spiniform termination is imperfect.

Beak sub-anterior, prominent, directed forward. Umbonal region gibbous, subtending an acute angle.

Anterior end large, abruptly acute at the extremity, limited by a distinct, nearly vertical byssal depression. Wing narrow-triangular, joining the body at the posterior extremity; margin very oblique below, concave above, abruptly recurved just below the cardinal line and extended into a spiniform process. In a cast of the left valve the wing is distinctly separated from the body by a marked furrow.

Test moderately thick, marked by elevated lamellose striæ, with finer intermediate lines.

Interior unknown.

The specimen described has a length of 42 mm., height 24 mm.; hinge-line, to base of spine, 30 mm. The spine is probably extended from 5 to 10 mm. beyond.

This species resembles *L. lepidum*, but differs in its more gibbous form, larger and more obtuse anterior extremity.

Formation and locality. In sandstones of the Upper Chemung group, McKean county, Pa., on the road from Bradford to Farmers' Valley, Cattaraugus county, N. Y.

SECTION *b*, *umbonata.*

LEPTODESMA MEDON, n. sp.

PLATE XC, FIGS. 1-4.

SHELL of medium size, sub-rhomboidal; body broad-ovate, oblique at an angle of about 60° with the hinge-line; length nearly one-third greater than the height; ante-byssal margin curving slightly outward, concave at the sinus; basal and posterior margins broadly rounded, passing directly into the wing.

Left valve gibbous above, depressed-convex below. Right valve somewhat less convex than the left. The right valve appears to have been somewhat smaller and the base more extended than in the left valve.

Hinge-line straight; length a little greater than the height of the shell.

Beaks at about the anterior third of the hinge, acute, prominent, arching over the hinge-line. Umbonal region gibbous, descending almost vertically on the posterior, and sloping abruptly on the anterior side. Umbonal angle acute.

Anterior end short, separated from the body by a marked sinus; extremity angular, gently rounded below. Wing not defined, broad-triangular, reaching nearly to the posterior end of the body; margin slightly concave; extremity acute.

Test thin, marked by concentric striæ, which, on the body of the shell, are crowded into fascicles and assume a distinct regularity in passing over the wing. The hinge shows one or two slender parallel grooves.

Three similar specimens of the left have respectively the following dimensions: length 32, 32 and 33 mm., height 22, 25 and 23 mm., and hinge-line 25, 27 and 25 mm.

In this species the body of the shell resembles *L. robustum* and *L. potens*, but is less oblique to the hinge-line, the wing less defined, and its posterior extremity not produced into a spine.

Formation and locality. In the upper part of the Chemung group, Lawrenceville, Tioga county, Pa.

LEPTODESMA UMBONATUM.

PLATE XXII, FIG. 13; AND PLATE XC, FIG. 9.

Leptodesma umbonatum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 13. Jan., 1883.

SHELL of medium size, rhomboidal; body oblique, narrowly ovate; greatest length one-half more than the height; ante-byssal margin straight or slightly convex, curving into the wide sinus, oblique below; ventral margin broadly rounded; posterior extremity moderately produced, abruptly recurved.

Left valve convex, ventricose above the lower third. Right valve unknown.

Hinge-line straight; length less than the length of the shell.

Beak at about the anterior third of the cardinal line, directed slightly forward, prominent and arching over the hinge. Umbonal region narrow and ventricose, defined anteriorly by a broad, shallow depression, which is nearly vertical to the hinge-line, and posteriorly by the abrupt depression of the body.

Anterior end acute, triangular. Wing rather large, triangular, convex, joining the body of the shell near the posterior extremity; margin broadly concave; extremity produced, acute.

Test thin, marked by fine concentric lines of growth which are irregularly crowded into small fascicles, producing a slightly undulated appearance. The striæ are strong and regular over the wing.

Interior unknown.

The left valve described has a length of 41 mm., height 27 mm., hinge-line about 38 mm.

This species bears some general resemblance to *L. potens* and *L. robustum*, but the body is narrower, less oblique and much more gibbous, the beak more elevated, and the posterior extremity of the body less expanded. The wing is also much larger than in *L. robustum*. It is very closely allied to *L. umbonatum* var. *depressum*, Pl. xxii, fig. 14., but differs in its smaller mucronate anterior end; the body is more convex and narrower below, and the extremity of the wing more produced.

Formation and locality. In a calcareous band of the upper part of the Chemung group, Twenty-mile creek, Chautauqua county, N. Y.

LEPTODESMA UMBONATUM, var. DEPRESSUM.

PLATE XXII, FIG. 14; AND PLATE XC, FIG. 10.

Leptodesma umbonatum, var. depressum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 14. Jan., 1883.

SHELL of medium size, rhomboidal; body very oblique-ovate; length once and a half greater than the height; ante-byssal margin, below the acute extremity, regularly curving into the ventral margin; posterior extremity produced, with the margin gently recurving into the wing.

Left valve convex below, gibbous above. Right valve smaller, a little less convex, abruptly gibbous on the umbo.

Hinge-line straight, somewhat less than the greatest length of the shell.

Beaks sub-anterior, obtuse, directed slightly forward, very prominent, arching over the hinge-line.

Anterior end short, large, limited by a broad, undefined depression; extremity produced, acute. Wing large, triangular, not distinctly defined, joining the body near the posterior end; extremity produced, acute, and probably extended into a short spine.

Test marked by fine striæ of growth which are irregularly fasciculate, producing a slight undulation of the surface. The striæ are lamellose on the anterior side and regular on the wing.

Interior unknown.

The specimen described has a greatest length of about 40 mm., height 25 mm., and hinge-line 35 mm.

This form differs from *L. umbonatum* in the lesser convexity and greater width of the lower part of the body; less abrupt depression on the anterior side from the umbo; the posterior slope less elevated and defined below the middle, and a much larger ante-byssal portion of the shell.

Formation and locality. In the upper part of the Chemung group, Napoli Centre, Cattaraugus county, N. Y.

LEPTODESMA NAVIFORME.

PLATE XXII, FIG. 15; AND PLATE XXIII, FIG. 1.

Leptodesma naviforme, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 15; pl. 23, fig. 1. Jan., 1883.

SHELL below the medium size, rhomboidal; body very oblique, short-ovate; length more than one-third greater than the height; anterior extremity subtruncate; margin curving to the broadly rounded base; posterior margin slightly produced, gently curving forward, nearly vertical.

Left valve convex below, very gibbous above the middle. Right valve depressed-convex below, gibbous above.

Hinge-line straight, more than one-third greater than the height of the shell.

Beaks obtuse, situated at the anterior fourth of the hinge-line, prominent, directed slightly forward. Umbonal region gibbous, sloping abruptly into the wing.

Anterior end short, acute. Wing large, not distinctly limited, extending almost to the posterior extremity; margin scarcely concave below; extremity produced, acute.

Test marked by fine concentric striæ, which are crowded into fascicles at nearly equal intervals, rounded upon the upper part of the body, and sub-angular on the lower part. The striæ are crowded and lamellose on the anterior; on the posterior slope they make a short abrupt curve, passing over the wing with a gently forward direction and curving backward just below the hinge-line. In the weathered surface of the right valve the concentric undulations are stronger, the post-cardinal slope is marked by strong interrupted radii which appear to belong to the intimate structure of the shell. The hinge is marked by a single narrow groove.

A specimen of the left valve has a length of 22 mm., height 14 mm., and hinge-line about 21 mm. A right valve occurring in the same association has a length, from beak to base, of 26 mm., height 18 mm., and hinge-line about 25 mm.

This species is quite unlike any here described.

Formation and locality. In the lower beds of the Chemung group at the Inclined Plane, near Ithaca, N. Y.

LEPTODESMA CADMUS, n. sp.

PLATE XC, FIGS. 6, 7.

SHELL of medium size, rhomboidal; body oblique, narrowly ovate or sub-cylindrical; length nearly one-third greater than the height; ante-byssal margin somewhat vertically truncate, sloping below into the broadly curving base; posterior margin abruptly curved.

Valves convex, gibbous above; the right valve smaller than the left.

Hinge-line straight, nearly equal to the height of the shell.

Beaks at about the anterior third of the hinge-line acute, directed forward, prominent, arching over the cardinal line. Umbonal region abruptly gibbous, subtending an acute angle.

Anterior end small, terminating in a narrow nasute extension. Wing comparatively large, triangular, joining the body near the posterior end; surface concave; margin gently sinuate; extremity produced into a short spiniform extension.

Test thin, marked by fine concentric striæ, which are somewhat regularly fasciculate on the body of the shell, crowded and sub-lamellose on the anterior, and regular over the wing, curving backward just below the hinge, indicating a spiniform extension of the wing. On the body of the right valve the striæ form sharp, lamellose elevations at somewhat equal intervals.

The hinge is marked by one or two narrow, longitudinal grooves.

A left valve has a length of 34 mm., height 24 mm., and hinge-line 22 mm. A similar specimen, somewhat vertically compressed, has a length of 36 mm., height 24 mm., hinge-line 25 mm.

This species resembles *L. umbonatum var. depressum*, but differs in its smaller and narrower anterior end and more cylindrical body, and wing without a broad sinus in the margin.

Formation and localities. In the upper beds of the Chemung group, Steuben county, N. Y., and Tioga and Bradford counties, Pa.

LEPTODESMA CREON, n. sp.

PLATE XC, FIGS. 11-13.

SHELL below medium size, sub-rhomboidal; body ovate, oblique to the hinge-line at an angle of about 55°; length nearly one-third greater than the height; ante-byssal margin slightly oblique or rounded, distinctly sinuate below, then gently curving to the broad base; posterior margin broad, joining the wing without interruption.

Left valve convex below, gibbous above. Right valve less gibbous than the left and more expanded.

Hinge-line straight; length a little greater than the height of the shell.

Beaks at about the anterior third of the hinge-line, sub-acute, directed forward, prominent, arching over the hinge. Umbonal region very gibbous, narrow, limited by the abrupt slope of the posterior side. Umbonal angle acute.

Anterior end large, short, rounded, curving into the byssal sinus, defined by a marked byssal depression; extremity acute. Byssal sinus marked by a broad, shallow curvature of the margin. Wing small, narrow-triangular, not distinctly limited; margin concave; extremity acute. The wing of the right valve is comparatively larger.

Test thin, marked by fine concentric lines of growth, which are sometimes regular or often crowded into fascicles on the body of the shell.

Cardinal line marked by a narrow longitudinal groove. Interior unknown.

A left valve has a length of 32 mm., height 21 mm., hinge-line 23 mm. A smaller specimen has a length of 29 mm., height 20 mm., hinge-line 22 mm.

This species resembles in general expression *L. umbonatum var. depressum*, but it is uniformly smaller, the anterior end shorter, byssal depression narrower, wing smaller, the recurving of the posterior margin of the body less abrupt, the limits of the wing less distinctly marked, the extremity less produced, and the umbonal region not so abruptly gibbous.

Formation and locality. In the upper part of the Chemung group, Lawrenceville, Tioga county, Pa.

LEPTODESMA DEMUS, n. sp.

PLATE XC, FIGS. 15, 16.

SHELL of medium size, rhomboidal; body very oblique, narrowly ovate; extreme length more than one-third greater than the height; ante-byssal margin oblique, rounded below, concave at the sinus; basal margin broadly rounded; posterior margin abruptly curved.

Left valve convex, gibbous above. Right valve of similar form, less convex, and in the posterior part wider and more depressed.

Hinge-line straight, about two-thirds as long as the length of the valve.

Beaks situated at about the anterior third of the hinge, prominent, directed forward and rising a little above the cardinal line. Umbonal region gibbous, defined on the anterior by the byssal depression, and on the posterior by the slope of the side.

Anterior end large, limited by an oblique byssal depression, angular at the extremity and rounded below. Byssal sinus extending to a point more than one-third the height of the valve below the beak. Wing narrow-triangular, not distinctly limited; margin oblique, slightly convex, recurving just below the hinge-line; extremity angular.

Test marked by fine, irregular striæ, somewhat fasciculate on the body, and crowded and lamellose in front.

Interior unknown.

A well-preserved left valve has a length of 35 mm., height 20 mm., hinge-line nearly 24 mm.

The body of the valve in this species is narrower and more elongate than in *L. Creon*, and the wing smaller and less distinctly defined. It resembles *L. Lichas*, but differs in its more gibbous umbo, stronger byssal depression, less oblique margin of wing, with less acute termination and proportionally shorter body.

Formation and locality. In sandstones of the Chemung group at Lawrenceville, Tioga county, Pa.

LEPTODESMA LOXIAS, n. sp.

PLATE XC, FIG. 14.

SHELL of medium size, rhomboidal; body ovate, narrow above, oblique to the hinge-line at an angle of about 40°; height one-third less than the length; ante-byssal margin oblique, rounding into the sinus; ventral margin broadly rounded; posterior margin abruptly recurved.

Left valve convex, gibbous in the middle and above. Right valve unknown.

Hinge-line straight, greater than the height of the shell.

Beak obtuse, prominent, arching over the cardinal line, situated at the anterior third of the hinge. Umbonal region narrow and gibbous, subtending an acute angle.

Anterior end limited by a broad, nearly vertical byssal depression which extends one-half the height of the valve; margin convex; extremity acuminate. Wing triangular, not distinctly limited, joining the body near the posterior extremity; margin oblique, nearly straight, concave just beneath the hinge-line; extremity mucronate.

Test thin, marked by fine concentric striæ, which are regular over the body and wing and strongly lamellose and fasciculate on the anterior end.

Interior unknown.

A small left valve has a greatest length of 28 mm., height 17 mm., hinge-line 21 mm.

This species is distinguished from *L. Creon* and *L. Demus* by its narrower anterior end and more rounded ventral margin.

Formation and locality. In the Chemung group, Lawrenceville, Tioga county, Pa.

LEPTODESMA MENTOR, n. sp.

PLATE XC, FIG. 5; AND PLATE XXIII, FIG. 15?

SHELL of medium size, sub-rhomboidal; body elongate-ovate, narrow at the anterior end, oblique, making an angle of about 40° with the hinge-line; length one-third greater than the height; ante-byssal margin oblique, curving into the gently depressed sinus; basal margin broadly curving into the rounded posterior extremity.

Left valve moderately convex in the lower part, becoming convex in the middle and gibbous above. Right valve unknown.

Hinge-line straight; length about equal to the height of the valve.

Beak sub-anterior, directed forward, acute, but little elevated above the hinge-line. Umbonal region abruptly, or sub-angularly gibbous, narrow, subtending an acute angle.

Anterior end small, narrow, limited by an oblique byssal depression which reaches about half way down the body of the shell; extremity pointed.

Wing joining the body near the post-extremity of the shell, defined by a shallow groove; margin oblique, straight, apparently slightly concave just below the cardinal line.

Test thin, leaving upon the cast the marks of the striæ of growth which have been somewhat fascicled upon the body, giving it an obscurely undulated appearance.

Interior unknown.

A specimen of this species has a length of 35 mm., height 24 mm., and hinge-line nearly 24 mm.

This species resembles *L. Orodes*, but differs in its greater obliquity; the body is more attenuate toward the anterior, and the wing is distinctly limited. This one, and several other species, have shown the presence of an alar furrow and obscure fold, similar to PTYCHOPTERIA.

Formation and locality. In a coarse sandstone of the Upper Chemung group, south of Smethport, McKean county, Pa.

LEPTODESMA ORODES.

PLATE XXV, FIGS. 6, 9, (10?); AND PLATE XC, FIG. 8.

Leptodesma Orodes, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, figs. 6, 9 (10?). Jan., 1883.

SHELL of medium size, sub-rhomboidal; body ovate, oblique to the hinge-line at an angle of about 55°; length one-fifth greater than the height; ante-byssal margin a little oblique, nearly vertical above, curving into a long, undefined sinus; ventral margin rounded into the broad posterior curve.

Left valve moderately convex in the lower part, increasing in convexity to the middle of the length, where it becomes gibbous. Right valve unknown.

Hinge-line straight, a little less than the height of the valve.

Beak sub-anterior, directed forward, moderately prominent, scarcely rising above the cardinal line. Umbonal region abruptly gibbous, subtending an angle of about 30°.

Anterior end short in the direction of the hinge-line, separated from the body by a well-marked byssal depression extending for half the height of the valve; extremity abruptly angular. Wing large, joining the body below the middle of its length, obscurely defined from the body of the valve; margin moderately oblique, nearly straight, or slightly convex below, with a very gentle concavity just beneath the cardinal line.

Test thin; casts of the interior obscurely marked by fine striæ of growth which are sometimes fasciculate upon the body of the shell.

Interior unknown.

An individual of medium size has a length of 32 mm., height 27 mm., and hinge-line 23 mm. A smaller example has a length of 25 mm., height 20 mm., and hinge-line 18 mm.

This species is distinguished from *L. Maclurii* by its shorter form, less parallel sides of the body, larger wing, which is not extended on the cardinal margin, and the body is not angular along its entire length.

The specimen, Pl. xxv, fig. 10, has been flattened by pressure and is referred with doubt to this species. It has the same general aspect, but is proportionally wider below the middle, and more broadly rounded on the post-basal margin, which peculiarities may have been produced by compression.

Formation and locality. In a coarse sandstone of the Upper Chemung group, on the road from Olean, N. Y., to Smethport, Pa.

SECTION *c*, *rostrata*.

LEPTODESMA EXTENUATUM.

PLATE XXII, FIG. 23; AND PLATE XC, FIGS. 17, 18.

Leptodesma extenuatum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 23. Jan., 1883.

SHELL of medium size, elongate, semi-ovate; body narrowly ovate and oblique to the hinge-line at an angle of about 30°; length nearly twice the height; ante-byssal margin very oblique, scarcely depressed at the sinus, thence nearly straight to the broadly curved base; posterior margin abruptly recurved.

Left valve moderately convex below, gibbous on the umbo. Right valve flat below, depressed-convex in the middle, and more convex above, proportionally wider than the left, and distinguished by its depressed-convex form.

Hinge-line straight; length greater than the length of the valve.

Beak of left valve sub-anterior, acute, directed forward, rising slightly above the hinge-line. Beak of right valve depressed, not rising above the cardinal line. Umbonal region of left valve moderately gibbous, subtending a very acute angle.

Anterior end greatly extended, acute, rostrate, limited by a shallow byssal depression. Wing narrow-triangular, joining the body at the posterior extremity, defined by the recurving of the striæ; margin abruptly and symmetrically concave; extremity produced beyond the posterior limit of the shell.

Test thin, marked by fine, sharp, closely arranged, concentric striæ, which are sometimes fasciculate upon the body and anterior side, and very distinct upon the wing. Partial casts of the interior of the left valve give indications of fine radii which appear to belong to the intimate structure of the shell.

Characters of the interior unknown.

A left valve has a length of 32 mm., height 16 mm., and hinge-line 37 mm. A right valve has a length of 34 mm., height 19 mm., and hinge-line 40 mm.

This species is distinguished by the great length of the hinge-line, its narrow outline, and anterior extension. It approaches Pteronites in character, but differs in having a distinct wing, more depressed form, and a recurvation of the striæ along the post-umbonal slope.

Formation and localities. In the Chemung group, Philipsburg, Alleghany county, N. Y., and Kelly's creek, Tioga county, Pa.

LEPTODESMA HECTOR, n. sp.

PLATE XC, FIGS. 19, 20.

SHELL of medium size, sub-rhomboidal; body narrowly elongate-ovate, oblique at an angle of about 30° with the cardinal line; length a little more than once and a half the height; ante-byssal margin oblique, curving into a broad, shallow sinus; ventral margin broadly curved; posterior margin abruptly recurved.

Left valve moderately convex below, narrowly gibbous above. Right valve depressed below, gently convex above.

Hinge-line straight; length equal to about four-fifths of the length of the valve.

Beaks sub-anterior, directed forward, acute, slightly elevated above the hinge. Umbonal angle very acute.

Anterior end narrow, small, produced into an acute extension, defined by a shallow byssal depression. Wing large, joining the body at three-fourths or more of its length from the beak; margin very oblique below, deeply sinuate just beneath the cardinal line, turning abruptly backward and terminating in a spiniform extension. The wing of the right valve is scarcely defined, and the shell has a somewhat broadly spatulate aspect.

Test thin, marked by fine, close, concentric striæ, and, as usually seen, the surface shows nearly equally distant lamellose striæ on the body and wing, which are crowded on the anterior side and extension. In the right valve these characters are more subdued on the body than on the wing. In ordinary conditions, the specimens mostly exhibit only obscure indications of the striation of the shell.

Muscular impression in the right valve large, sub-circular, placed below the middle of the length of the posterior slope.

A left valve, of the usual size, has a length of 35 mm., height 20 mm., hinge-line 27 mm. A small specimen has a length of 20 mm., height 12 mm., and hinge-line 16 mm. Young shells of this species are more gibbous than the older examples.

This species resembles, in its general form, *L. extenuatum*, but the body is narrower at the beak, the wing less extended, and the greatest concavity of the margin is just below the cardinal line; while in that species it is near the middle; the anterior extremity is also less prolonged.

Formation and locality. In the upper shales of the Chemung group near Canton, Bradford county, Pa.

LEPTODESMA CLITUS, n. sp.

PLATE XC, FIG. 21.

SHELL of medium size, narrowly sub-rhomboidal; body elongate-ovate, oblique to the hinge-line at an angle of about 30°; length less than twice the height; ante-byssal margin very oblique; ventral margin broadly rounded, somewhat abruptly recurved at the post-basal extremity.

Left valve depressed-convex below, convex above, moderately gibbous on the umbo. Right valve unknown.

Hinge-line straight, less than the greatest length of the shell.

Beak sub-anterior, directed forward, moderately prominent. Umbonal region gibbous, subtending an acute angle.

Anterior end narrow, prolonged into a rostrate extension, defined by a strong byssal depression. Wing narrow-triangular, joining the body near the posterior end, defined only by the abrupt recurving of the striæ; margin deeply and abruptly concave, the deepest concavity about the middle; the extremity is an acute extension of the cardinal line.

Test thin, marked by fine concentric striæ, which are fasciculate upon the body, leaving the cast marked by gentle undulations, which are lamellose and elevated on the anterior side and rostral extension, and elevated on the wing.

Interior unknown.

A left valve has a length of 37 mm., height 20 mm., hinge-line 32 mm.

This species differs from *L. extenuatum* in its broader body, shorter hinge-line, and narrower wing; the striæ bend more abruptly forward along the post-cardinal slope, and the wing margin is more deeply concave.

Formation and localities. In shales of the Chemung group at Kelly's creek and Mansfield, Tioga county, Pa.

LEPTODESMA TRUNCATUM, n. sp.

PLATE XC, FIGS. 24, 25.

SHELL above the medium size, sub-rhomboidal; body ovate-elongate, oblique to the hinge-line at an angle of about 35°; length two-thirds greater than the height; ante-byssal margin oblique and often abruptly truncate, curving into the sinus; broadly rounded along the ventral margin, and more rapidly curving on the post-basal margin.

Left valve gently convex below, becoming more convex above, and somewhat gibbous on the umbo. Right valve less convex, flat in the lower part.

Hinge-line straight, nearly as long as the length of the shell.

Beaks sub-anterior, directed forward; in the left valve somewhat prominent; in the right valve not elevated above the hinge-line. Umbonal angle acute.

Anterior end obtuse, truncate, abruptly angular at the cardinal margin, limited by a slightly oblique byssal depression. Wing large, triangular, joining the body at the posterior extremity; margin sloping gently forward for two-thirds of the width, then abruptly recurved and extended in an acute or spiniform process. In the right valve the wing is less defined, and the anterior end is more strongly truncate.

Test thin, marked by sharp, elevated, distant, concentric striæ, with intermediate finer lines of growth. The stronger striæ are regular upon the wing and posterior part of the shell, fasciculate on the anterior side, and stronger and lamellose on the anterior extremity.

Interior unknown.

A left valve has a length of 38 mm., height 22 mm., and hinge-line 37 mm.

This species may be known by its truncate anterior end. The form of the body is very similar to *L. extenuatum*, but it is somewhat more convex and a little wider; the wing margin is less concave and the extremity less extended. The right valves of these two species are conspicuously different.

Formation and locality. In the central portion of the Chemung group, Mansfield, Tioga county, Pa.

LEPTODESMA CORYDON, n. sp.

PLATE XC, FIG. 22.

SHELL above the medium size, sub-rhomboidal; body narrowing very rapidly toward the beak, oblique to the hinge-line at an angle of about 30°; length less than twice the height; ante-byssal margin oblique, nearly straight, slightly impressed at the sinus, broadly curved at the base and rounded on the posterior extremity.

Left valve depressed-convex below and slightly gibbous on the umbo (as preserved in thinly laminated shale). Right valve unknown.

Hinge-line straight, about equal to the greatest length of the shell.

Beak sub-anterior, directed forward, little elevated above the cardinal line. Umbonal region moderately gibbous, subtending an acute angle.

Anterior end narrow, rostrate, acute, extended, defined by a distinct, shallow, byssal depression which produces a long, gentle curvature in the margin of the valve. Wing narrow, joining the body at nearly the posterior extremity; margin abruptly recurved below and somewhat deeply concave a little below the cardinal line; extremity forming a spiniform extension.

Test thin, marked by fine concentric striæ, which are fasciculate on the body at unequal distances, and sharply elevated and more distinct on the wing.

Interior unknown.

A left valve of medium size has a length of 42 mm., height 25 mm., hinge-line about 40 mm.

Compared with *L. Clitus*, the body of the shell is more elongate-ovate or sub-spatulate, narrowing more rapidly toward the post-extremity; the wing is wider and the sinuosity less deep, its greatest depth being near the cardinal line.

Formation and locality. In the Chemung group, Kelly's creek, Tioga county, Pa.

LEPTODESMA JASON, n. sp.

PLATE XCI, FIGS. 4–6.

SHELL above the medium size, sub-triangular; body elongate-ovate or sub-spatulate, attenuate toward the anterior end, oblique at an angle of about 40° with the hinge-line; length once and a half the height; margin of the anterior end gently curving into the undefined byssal sinus; thence nearly straight to within one-fourth the length of the valve from the posterior extremity, which is regularly and broadly rounded.

Left valve regularly convex below, narrow and gibbous above. Right valve depressed-convex below, more convex above, and moderately gibbous in the umbonal region.

Hinge-line straight, somewhat less than the greatest length of the body.

Beaks sub-anterior, acute, directed forward, slightly elevated above the hinge-line. Umbonal region abruptly gibbous, subtending a very acute angle.

Anterior end short. Wing joining the body near the posterior extremity; margin regularly concave, the greatest concavity near the middle of the width, terminating in a short spiniform extension. In the right valve the wing is proportionally larger and less defined.

Test thick, marked upon the body and wing with sharp, elevated, lamelliform striæ and intermediate finer striæ; on the anterior the striæ are fasciculate.

Interior unknown.

A large left valve has a length of 40 mm., height 26 mm., hinge-line 32 mm. A right valve has a length of 36 mm., height 20 mm., and hinge-line 34 mm.

This species resembles *L. Hector* in general form, but is broader at the posterior end, more abruptly gibbous along the axis above the middle, the wing joins the body nearer the posterior extremity, and the margin of the wing has the deepest concavity in the centre of its width. The right valve is more convex than the right valve of *L. Hector*, and the concentric elevated striæ are much stronger. In all these characters it also differs more extremely from *L. extenuatum.*

Formation and locality. In compact sandstone of the Upper Chemung group, alternating with some red beds, on Seely creek, Tioga county, Pa.

LEPTODESMA PELOPS, n. sp.

PLATE XC, FIGS. 28, 29.

SHELL larger than the medium size, sub-rhomboidal; body ovate, oblique at an angle of about 40° with the hinge-line; height two-thirds the greatest length; ante-byssal and ventral margins very oblique and continuing in nearly a straight line for two-thirds the length, with a slight concavity for the byssal sinus; posterior margin very broadly curving.

Left valve depressed-convex below, gradually becoming more convex above the middle, and somewhat gibbous on the umbo. Right valve unknown.

Hinge-line straight, nearly equal to the greatest length of the shell.

Beak sub-anterior, inclined forward, obtuse, scarcely elevated above the hinge-line. Umbonal angle acute.

Anterior end triangular, prolonged, acute. Wing joining the body of the shell at the posterior extremity; margin symmetrically concave; extremity produced and acutely angular.

Test marked by distant, sub-equal, lamellose elevated striæ, with finer intermediate striæ. The stronger striæ are regular on the wing and posterior slope of the body, and become irregular and fasciculate on the anterior side and lower half.

Interior unknown.

The hinge shows a narrow striated ligamental area, and, apparently, a slender lateral tooth.

A large left valve has a length of 44 mm., height 28 mm., and hinge-line 42 mm.

This form is more oblique, and the wing is longer and narrower than in *L. Orodes.*

Formation and locality. In the Upper Chemung group, Mansfield, Tioga county, Pa.

LEPTODESMA ORCUS, n. sp.

PLATE XC, FIG. 23.

SHELL of medium size, sub-rhomboidal; body ovate, straight on the posterior slope, oblique to the hinge-line at an angle of about 40°; length about one-third greater than the height; ante-byssal margin oblique, slightly impressed at the sinus, nearly straight along the base and regularly rounded posteriorly.

Left valve symmetrically and gently convex below, slightly gibbous above. Right valve unknown.

Hinge-line straight; length equal to three-fourths the length of the shell.

Beak anterior, acute, little elevated above the hinge-line. Umbonal region narrowly gibbous, subtending a very acute angle.

Anterior end short, limited by an oblique byssal depression; extremity acute. Wing of medium size, joining the body about three-fourths its length from the beak; margin abruptly curving forward from the base to near the hinge-line, where it is sharply recurved into a short, angular extension of the cardinal line.

Test thin, marked by fine concentric striæ, which are somewhat fasciculate on the body and anterior part of the shell, and a little more sharply elevated on the wing.

Interior unknown.

The specimen illustrated has a length of 30 mm., height 22 mm., and hinge-line 24 mm.

The form and proportions of body are quite similar to *L. Lysander*, but it is wider on the posterior, narrower on the anterior end, and more oblique to the hinge; the striæ less sharply elevated, curving more forward along the posterior slope, and more abruptly recurved under the cardinal line.

Formation and locality. In the Chemung group at Kelly's creek, Tioga county, Pa.

LEPTODESMA LYSANDER.

PLATE XXII, FIG. 22; AND PLATE XC, FIG. 34.

Leptodesma Lysander, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 22. Jan., 1883.

SHELL of medium size, sub-rhomboidal; body ovate, abruptly narrowing toward the front, oblique to the hinge-line at an angle of about 45°; length one-third greater than the height; ante-byssal margin oblique above, curving into the marked sinus, regularly rounded along the base and posterior extremity.

Left valve depressed-convex below, more convex above, and moderately gibbous on the umbo. Right valve unknown.

Hinge-line straight, about equal to the greatest length of the valve.

Beak sub-anterior, moderately prominent. Umbonal region but slightly gibbous, subtending an acute angle.

Anterior end broad, obliquely truncate; extremity slightly extended and acute. Wing narrow-triangular, joining the body at the posterior extremity; margin concave, greatest concavity just above the middle, thence turning outward it is produced into a spiniform extension of the cardinal line.

Test marked by fine concentric striæ, with sharp lamellæ at nearly regular intervals over the body and wing, becoming crowded and fasciculate on the anterior of the shell.

Interior unknown.

A specimen has a length of 35 mm., height 24 mm., and hinge-line 33 mm.

This species differs from *L. Corydon* in its shorter and broader form; the body is less oblique and more abruptly narrowed toward the anterior; the striæ are less abruptly recurved along the posterior slope.

Formation and localities. In shales of the Chemung group at Kelly's creek and Mansfield, Tioga county, Pa.

LEPTODESMA NEREUS, n. sp.

PLATE XC, FIGS. 31–33.

SHELL of medium size, sub-rhomboidal; body broadly ovate, narrowing rapidly to the anterior end, and oblique to the hinge-line at an angle of 45°; length less than one-third greater than the height; ante-byssal margin gently curved, extending into a wide sinus, broadly rounded along the base, curving regularly on the post-basal side and abruptly recurved in the upper part.

Left valve gently convex below, more convex above, and moderately gibbous on the umbo. Right valve smaller, more depressed below, nearly equally convex toward the umbo.

Hinge-line straight, less than the length of the valve.

Beaks sub-anterior, acute, directed forward, rising slightly above the hinge-line. Umbonal region gibbous in the left valve, narrower but equally gibbous in the right valve. Umbonal angle acute.

Anterior end small, abruptly curving into the byssal depression; extremity acute, not prolonged. Wing broad, extending along the body about four-fifths of its length from the beak; margin very oblique in the lower part and moderately concave above the centre, then turning abruptly backward just below the cardinal line, and produced into a short spiniform extension. In the right valve the wing is less defined and less concave on the margin.

Test thin, marked by concentric striæ, which are fasciculate on the body and anterior part, and more elevated, distant and sharp upon the wing.

Muscular impression large, sub-circular, situated on the posterior slope below the middle of the length. The pallial line extends from the lower part of the muscular impression nearly parallel to the anterior and basal margin. The hinge of the left valve has a strong groove extending its entire length; the right valve has an oblique posterior fold.

One specimen has a length of 35 mm., height 26 mm., hinge-line 31 mm. A similar example has a length of 34 mm., height 24 mm., and hinge-line 28 mm. A right valve has a greatest length of 31 mm., height 20 mm., and hinge-line 25 mm.

This species resembles *L. Orcus*, but the wing is wider, less deeply and abruptly sinuous, and the striæ turn more abruptly forward at the junction of the body and wing. The body is narrower and more oblique than in *L. Lysander*, and the anterior end less prolonged.

Formation and locality. In the shales of the Upper Chemung group near Canton, Bradford county, Pa.

LEPTODESMA ALATUM, n. sp.

PLATE XC. FIGS. 26, 27.

SHELL of medium size, sub-rhomboidal; body ovate, rapidly narrowing toward the beak, oblique, making an angle of about 50° with the hinge-line; length one-third greater than the height; ante-byssal margin oblique and curving into the distinct sinus; ventral margin gently curved, joining the broad, rounded, posterior extremity.

Left valve gently convex below, becoming more convex and slightly gibbous above the middle. Right valve depressed in the lower portion, in the middle and above about equally convex with the left.

Hinge-line straight, a little less than the length of the valve, and greater than the height.

Beaks sub-anterior, directed forward, acute, but little elevated above the hinge-line in the left valve. Umbonal region narrow, and abruptly gibbous. In the right valve the beak is depressed, and the umbonal region a little less gibbous than in the other valve.

Anterior end small, acute at the extremity, rounded below to the distinct byssal sinus. Wing large, wide-triangular, joining the body at the posterior extremity; margin moderately concave, the greatest concavity being above the middle, from which point it turns abruptly outward and the extremity is produced into a spiniform extension. In the right valve the wing is less distinctly limited from the body than in the left.

Test thin, marked by sharp, elevated, concentric striæ, with finer intermediate lines of growth. The stronger striæ are somewhat regular upon the body and wing, while on the anterior side they are crowded and fasciculate.

Muscular impression large, sub-circular, situated below the middle of the posterior slope. The pallial line extends from the lower part of the muscular impression, parallel to the basal and anterior margins, into the cavity of the beak. Ligamental area wide.

A left valve of this species has a length of 35 mm., height 26 mm., and hinge-line 33 mm. A somewhat larger right valve has a length of 38 mm., height 28 mm., and hinge-line 33 mm.

Formation and locality. In the shales of the Chemung group at Canton, Bradford county, Pa.

LEPTODESMA ORUS, n. sp.

PLATE XC, FIG. 30.

SHELL above the medium size, sub-rhomboidal; body broadly ovate, abruptly contracted towards the anterior end, oblique at an angle of about 50° with the hinge-line; ante-byssal margin oblique, curving into the marked sinus, thence gently curving to the posterior extremity, which is broadly rounded.

Left valve depressed-convex below, moderately convex above. Right valve unknown.

Hinge-line straight; length about five-sixths the greatest length of the valve.

Beak sub-anterior, directed forward, slightly rising above the cardinal line. Umbonal region moderately gibbous, subtending an acute angle.

Anterior end triangular, abruptly acute at the extremity, defined by a marked byssal depression. Wing large, triangular, without distinct limitation, joining the body near the posterior extremity; margin oblique below, concave above the middle, turning abruptly outward and terminating in a sharply angular extension of the cardinal line.

Test thin, marked by sharp, elevated, concentric striæ with finer intermediate ones. The stronger striæ are regular on the wing and posterior side; irregular and fasciculate on the anterior.

Interior unknown.

Two left valves have respectively these dimensions: length 48, and 42 mm., height 32, and 30 mm., hinge-line 40, and 35 mm.

This species resembles *L. Pelops*, but the body is broader and less oblique, the anterior portion not so attenuate, the wing somewhat wider, the greatest sinuosity in the margin of the wing being nearer to the cardinal line, and the extremity of the wing more acuminate.

Formation and locality. In shales of the Chemung group, Mansfield, Tioga county. N. Y.

LEPTODESMA ALIFORME.

PLATE XXII, FIG. 28; AND PLATE XCI, FIG. 2.

Leptodesma aliforme, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22. fig. 28. Jan., 1883.

SHELL large (right valve), elongate, triangular; body narrow, spatulate, oblique at an angle of about 30° with the cardinal line; length twice the height; margin of shell oblique anteriorly, continued along the base in nearly a straight line for two-thirds its length, thence curving to the posterior extremity, which is abruptly rounded.

Right valve nearly flat below, depressed-convex in the middle, slightly gibbous in the umbonal region. Left valve unknown.

Hinge-line straight; length equal to the greatest length of the shell.

Beak sub-anterior, depressed, directed forward.

Anterior end narrow-triangular; extremity attenuate, very acute. Wing narrow, elongate, triangular, extending to the posterior extremity of the valve, not defined; margin concave, the greatest concavity below the middle; extremity slightly produced, angular.

Test not preserved. The specimen is a cast of the interior, showing some faint indications of concentric striæ.

Muscular impression large, situated at about the middle of the length of the posterior slope. Pallial line continued parallel to the anterior side, with slight interruptions, nearly to the beak. The hinge is furnished with a slender, oblique lateral tooth.

The specimen described is 60 mm. in length, with a height of 29 mm., and hinge-line 61 mm.

This species bears considerable resemblance to *L. extenuatum* in the characters of the right valve; but it is proportionally narrower, the posterior extremity more abruptly recurved and the hinge-line less extended behind. A single right valve is the only specimen at present known. It differs sufficiently from the other forms here described to be easily recognized.

Formation and locality. In a white sandstone of the middle portion of the Chemung group near Angelica, Alleghany county, N. Y.

LEPTODESMA RUDE.

PLATE XXV, FIG. 12; AND PLATE XCI, FIG. 3.

Leptodesma rude, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, fig. 12. Jan., 1883.

SHELL large, sub-rhomboidal; body broadly ovate below, rapidly attenuating above, oblique to the hinge-line at an angle of about 50°; length less than one-third greater than the height; ante-byssal margin curving into the broad sinus; ventral and posterior margins broadly rounded.

Left valve convex below, becoming narrow and gibbous above the middle. Right valve less convex.

Hinge-line straight, less than the length of the valve.

Beak sub-anterior, directed forward, acute, little elevated above the cardinal line. Umbonal region narrow and gibbous, subtending an acute angle.

Anterior end large, limited by a vertical byssal depression; extremity acute. Wing of moderate size, joining the body at the posterior extremity; margin concave; termination acute.

Test thick, marked by concentric striæ, which have been fasciculate, leaving strong undulations upon the cast of the interior. These surface characters are subdued in the right valve.

Interior unknown.

A left valve has a length of 51 mm., height 37 mm., hinge-line about 42 mm.

Specimens of this species usually present a very rough and irregular aspect from the character of the shell, with its strongly lamellose structure and the coarse matrix in which it is usually found. The specimen figured is a cast of the interior, and is distinguished by the broad posterior end and abrupt narrowing toward the front, the obtusely sub-angular umbo, and the large anterior end. In a crushed specimen retaining both valves, the right valve is almost equally convex with the left; the surface is less lamellose and presents only gentle undulations.

Formation and locality. In a coarse sandstone of the upper part of the Chemung group, on the road from Olean, N. Y., to Smethport, Pa.

LEPTODESMA BITON, n. sp.

PLATE XCI, FIG. 1.

SHELL large, sub-rhomboidal; body elongate-ovate, making an angle of about 45° with the hinge-line; height nearly two-thirds of the length; ante-byssal margin oblique, slightly curving into a long, shallow sinus, which impresses the margin for more than half the length of the valve; basal and posterior margins broadly rounded.

Left valve regularly and gently convex in the lower part, becoming more convex and gibbous above the middle. Right valve unknown.

Hinge-line straight, greater than the height of the valve.

Beak sub-anterior, directed forward, but little elevated above the hinge-line. Umbonal region abruptly gibbous, subtending an acute angle.

Anterior end produced, narrow, acute at the extremity, limited by an oblique, shallow byssal depression. Wing large, joining the body at the posterior end, not distinctly separated; margin slightly oblique below, gently concave above the middle, and curving slightly outward just below the cardinal line.

Test thin; cast marked by fine concentric striæ of growth, which, at intervals, have been elevated into fascicles, and on the external shell, were probably sharp lamellose striæ.

Interior unknown.

The specimen described has a length of 50 mm., height 31 mm., and hinge-line 35 mm.

This species resembles *L. Orodes*, and may be distinguished by the more extended and acute anterior extremity, and the larger wing which is distinctly concave on the margin and recurved just below the cardinal line. It differs from *L. Maclurii* in its more produced anterior extremity, and broader wing which is less abruptly recurved at the extremity.

Formation and locality. In a coarse sandstone of the Upper Chemung group, south of Smethport, McKean county, Pa.

LEPTODESMA LESLEYI, n. sp.

PLATE XCI, FIG. 7.

SHELL large, sub-rhomboidal; body narrow, elongate-ovate, making an angle of 30° with the cardinal line; length more than one-third greater than the height; ante-byssal margin oblique, nearly straight above, curving into the broad sinus; ventral margin broadly curved; posterior extremity abruptly rounded.

Left valve convex below, narrowly gibbous in the middle and on the umbo. Right valve less convex, depressed below.

Hinge-line straight, nearly equal to the greatest length of the shell.

Beaks sub-anterior, directed forward, acute and arching over the hinge in the left valve, depressed in the right valve. Umbonal region of the left valve narrowly gibbous, and subtending a very acute angle.

Anterior end large, limited by a broad, distinct, oblique byssal depression; extremity flattened and acuminate. Wing large, triangular, joining the body near the post-basal extremity, limited by the abrupt forward bending of the striæ; margin deeply concave; extremity produced and acute. The wing of the right valve is scarcely defined from the body and less deeply concave on the margin.

Test marked by fine, irregular, concentric striæ which are strongly fasciculate and lamellose on the ventral side and anterior end, and are shown on the wing as sharp, elevated, regular striæ. Some specimens preserve fine regular striæ on the body of the valve, but they are usually somewhat irregular and lamellose. In an exfoliated and macerated condition they show fine radiating lines which probably belong to the intimate structure of the shell.

Ligamental area (as preserved in an imperfect right valve) 1.5 mm. wide, and marked by very fine, minutely undulating longitudinal striæ. The hinge also shows an obscure oblique lateral tooth.

A left valve, of medium size, has a greatest length of 56 mm., height 31 mm., and hinge-line about 51 mm.

This species somewhat resembles *L. aviforme*, but is distinguished by its more oblique form, and wider anterior end. Specimens are quite abundant in an argillo-calcareous sandstone of the Upper Chemung group, associated with *Spirifera Verneuili*.

Formation and locality. In the Upper Chemung group, Auburn township, Susquehanna county, Pa.

LEPTODESMA AVIFORME, n. sp.

PLATE XCI, FIG. 8.

SHELL large, sub-rhomboidal; body elongate-ovate, broad behind, and rapidly narrowing toward the beak, oblique at an angle of a little less than 45° to the hinge-line; height more than one-half the length; ante-byssal margin very oblique, continued in a straight line into the shallow sinus, thence curving to the posterior extremity, which is broadly rounded.

Left valve gently convex below, very convex above, and moderately gibbous on the umbo. Right valve unknown.

Hinge-line straight; length a little more than the greatest length of the valve.

Beak sub-anterior, directed forward, acute, not rising much above the hinge. Umbonal angle acute.

Anterior end narrow, elongate, very acute, limited by a shallow byssal depression. Wing large, joining the body near the base; margin broadly and symmetrically concave; extremity produced into a spiniform extension reaching beyond the posterior extent of the shell.

Test marked by fine concentric striæ which are regular on the posterior part of the body and the wing, and very crowded and fasciculate on the anterior.

Interior unknown.

A large left valve has a length of 60 mm., height 37 mm., hinge-line 62 mm. A slightly larger, imperfect specimen has been found, the body of which, near the posterior extremity, has a greatest width of from 25 to 28 mm., and measures from 12 to 14 mm. in the narrow part between the beak and the byssal sinus.

This species differs from *L. Pelops* in the longer and more erect body, more attenuate anterior extremity, more extended wing and deeper sinus in the margin.

Formation and localities. In the middle beds of the Chemung group at Charleston, and near Mansfield, Tioga county, Pa.

SECTION *d, patulata.*

LEPTODESMA FLACCIDUM, n. sp.

PLATE XCI, FIG. 9.

SHELL of medium size, rhomboid-ovate, spatulate below; body oblique at an angle of about 45° to the hinge-line; length about one-third greater than the height; ante-byssal margin subtruncate, oblique, a little concave below, curving into the broad ventral margin; posterior margin abruptly rounded and recurved.

Left valve moderately convex in the middle, gibbous on the umbo, depressed-convex in the lower part. Right valve unknown.

Hinge-line straight; length about equal to the height of the shell.

Beak obtuse, directed forward, moderately prominent, situated anterior to the middle of the cardinal line. Umbonal region gibbous, subtending an acute angle.

Anterior end comparatively large, produced into a nasute extension. Wing small, narrow-triangular, joining the body of the shell more than one-third the height above the base; margin gently concave; extremity acute.

Test thin, marked by fine regular striæ of growth, which are fasciculate on the umbo and lamellose at nearly equal intervals on the lower part of the shell.

Interior unknown. The hinge is marked by a single slender groove.

A left valve has a length of 40 mm., height 27 mm., hinge-line about 27 mm.

This species resembles *L. complanatum*, but differs in its greater proportional length and the body is more depressed and extended below. It is characterized by the spatulate posterior extension, which is more extreme than in any other species here described.

Formation and locality. In the Chemung group, Lawrenceville, Tioga county, Pa.

LEPTODESMA PATULUM, n. sp.

PLATE XCI, FIGS. 10, 11.

SHELL above the medium size, sub-rhomboidal; body oblique, elongate, sub-ovate; length slightly more than one-third greater than the height; ante-byssal margin oblique, gradually curving to the ventral margin which is nearly straight; posterior margin broadly curved.

Valves moderately convex below, scarcely gibbous above, similar in form; the right valve being a little smaller and less convex than the left.

Hinge-line straight, somewhat longer than the height of the shell.

Beaks at about the anterior third of the hinge-line, directed forward, somewhat prominent. Umbonal region moderately gibbous, not strongly defined. Umbonal angle acute.

Anterior end large, produced into a nasute extension. Wing large, joining the shell at the posterior extremity; margin scarcely concave, abruptly produced along the hinge-line.

Test marked by fine lines of growth which are irregularly fasciculate, sometimes appearing as equidistant, sharply elevated lamellæ; crowded on the anterior; more regular over the wing and abruptly recurving just beneath the hinge.

The hinge is marked by one or two narrow, parallel, longitudinal grooves.

A specimen of medium size has a length of 40 mm., height 26 mm., and hinge-line 28 mm. A similar right valve has a length of 36 mm., height 24 mm., and hinge-line 27 mm.

This species differs from *L. flaccidum* in its much larger wing, which is more extended along the body of the shell. It is less convex and the umbo less gibbous than in any of the preceding species.

Formation and locality. In the upper part of the Chemung group at Mansfield, Tioga county, Pa.

LEPTODESMA COMPLANATUM.

PLATE XXII, FIG. 2.

Leptodesma complanatum, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 2. Jan., 1883.

SHELL of medium size, obliquely semi-elliptical; body sub-ovate, moderately oblique; length one-third greater than the height; ante-byssal margin subtruncate, gradually curving into the broad ventral margin; posterior margin abruptly rounded.

Left valve depressed-convex, a little gibbous on the umbo. Right valve unknown.

Hinge-line straight; length less than the height of the shell.

Beak acute, incurved, directed forward, moderately prominent. Umbonal region indistinctly defined anteriorly; the posterior side limited by the post-umbonal depression.

Anterior end short; extremity angular. Wing undefined, joining the body one-third of the length from the posterior extremity; margin gently concave; extremity scarcely produced.

Test marked by fine, sharply elevated, concentric striæ, which are more crowded anteriorly, and very regular on the wing.

Interior unknown.

The specimen described, which is a separate left valve, has a length of 28 mm., height 20 mm., and hinge-line 18 mm.

Formation and locality. In the shales of the Chemung group at Philipsburg, N. Y.

SECTION *e*, *arcoidea*.

LEPTODESMA MACLURII.

PLATE XXV, FIGS. 8, 13; AND PLATE XCI, FIGS. 13, 14.

Leptodesma Maclurii, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, figs. 8, 13. Jan., 1883.

SHELL large, rhomboidal; body elongate, sub-elliptical, oblique, making an angle of about 45° with the hinge-line; length more than one-third greater than the height; ante-byssal margin oblique, gently curving into a long, shallow, undefined sinus; ventral margin nearly straight, curving abruptly into the posterior margin, which is rounded and abruptly recurved.

Left valve moderately convex in the lower part, becoming gibbous and sub-angular along the line of the axis to the beak. Right valve distinctly arcuate, less convex, narrowly gibbous in the umbonal region.

Hinge-line straight; length about equal to the height of the valve.

Beaks sub-anterior, directed forward, but little elevated above the hinge-line in the left valve, depressed in the right. Umbonal angle acute.

Anterior end narrow-triangular, limited by an oblique depression which extends nearly one-third of the length of the valve to the byssal sinus.

Wing large, undefined; margin very oblique in the lower part, slightly concave above, the greatest concavity being a little below the hinge-margin; extremity produced into an angular extension. The right valve shows less distinction between the body of the valve and the wing.

Test thin, marked by distant lamellose lines of growth with intermediate finer striæ. These lines are more regular upon the wing and very much crowded and fasciculate upon the anterior side of the body.

Interior unknown.

Hinge, posterior to the beak, furnished with a slender lateral tooth

A left valve of this species has a length of 55 mm., height 35 mm., hinge-line 37 mm., and the body, at the posterior end, having a width of 25 mm. A right valve has a length of 45 mm., height 30 mm., and hinge-line about 28 mm.

The specimens of this species observed are casts of the interior in coarse sandstone, or impressions of the exterior in the same rock. The species is distinguished by its straight ventral side and the nearly parallel direction of the sides of the body in the left valve.

Formation and localities. In a coarse sandstone of the Upper Chemung group, on the road from Olean, N. Y., to Smethport, Pa., and at Bradford, Pa.

LEPTODESMA ARCIFORME, n. sp.

PLATE XCI, FIG. 12.

SHELL large, narrow, sub-rhomboidal; body sub-cylindrical, oblique at an angle of about 30° to the hinge-line; length nearly one-half greater than the height; anterior margin oblique, merging into the broad, low curvature of the ventral margin; posterior margin abruptly rounded and curving into the undefined wing.

Valves very convex, strongly gibbous, obtusely sub-angular along the middle; the greatest convexity distant from the beak one-third the height of the valve. The right valve is less gibbous, but otherwise similar to the left.

Hinge-line straight; length about equal to the height of the shell.

Beaks prominent, directed forward and arching over the hinge, situated at about the anterior third of the cardinal line. Umbonal region angularly gibbous above, abruptly defined along the posterior slope. Umbonal angle acute.

Anterior end short, angular. Wing an undefined, narrow-triangular expansion; margin straight or a little concave; extremity very slightly produced.

Test moderately thick, marked by fine concentric striæ, which are fasciculate on the body of the shell, and crowded and lamellose over the anterior side.

Interior unknown.

A large left valve has a length of 60 mm., height 36 mm., and hinge-line 37 mm.

This species is distinguished from *L. Lichas* by its larger and stronger form, being very gibbous along the entire length of the shell, and with a proportionally smaller wing.

Formation and locality. In the upper part of the Chemung group at Mansfield, Tioga county, Pa.

LEPTODESMA PHAON, n. sp.

PLATE XCI, FIG. 18.

SHELL above the medium size, narrow-rhomboidal; body sub-cylindrical, very oblique, making an angle with the hinge-line of less than 30°; length nearly twice the height; ante-byssal margin short, oblique, curving into the broad, almost straight ventral side; posterior margin abruptly but regularly rounded and continuous with the base of the wing.

Left valve very convex, gibbous above. Right valve unknown.

Hinge-line straight, somewhat longer than the height of the shell.

Beak at the anterior third of the hinge-line, obtuse, moderately elevated, directed forward. Umbonal region gibbous, not well-defined anteriorly, abruptly depressed on the posterior. Umbonal angle acute.

Anterior end short, acute at the extremity, defined by a slight bend in the striæ indicating the byssal sinus. Wing small, narrow-triangular, joining the body near the posterior end; margin straight, very oblique; extremity angular.

Test marked by strong concentric striæ, which at equal intervals are raised into sharp lamellæ, and are more crowded in front.

Interior unknown.

A left valve has a length of 47 mm., height 25 mm., and hinge-line 27 mm.

This species is remarkable for its extreme obliquity of body. In its general features it somewhat resembles *L. arciforme*, but differs in the less angular gibbosity of the body, larger wing, more extended anterior end, and in the surface markings.

Formation and locality. In the upper part of the Chemung group at Mansfield, Tioga county, Pa.

LEPTODESMA PROPINQUUM, n. sp.

PLATE XCI, FIGS. 16, 17.

SHELL of medium size, rhomboidal; body narrow, sub-cylindrical, very oblique, making an angle of about 30° with the hinge-line; length more than twice the height; anterior margin oblique; ventral margin nearly straight on the anterior half, and broadly curving over the lower half; posterior margin abruptly curved.

Valves gibbous, nearly equal in size and convexity.

Hinge-line straight, longer than the height of the valve.

Beaks at about the anterior third of the hinge-line, directed forward, very prominent, arching over the cardinal line. Umbonal region gibbous, limited posteriorly by the vertical descent of that side, scarcely defined on the anterior. The umbo and post-cardinal slope are obtusely sub-angular for about two-thirds of the length of the body. Umbonal angle acute.

Anterior end not defined (the byssal depression being obsolete); extremity acute. Wing small, narrow-triangular, joining the body near the posterior extremity, undefined; margin straight or slightly concave, very oblique; extremity slightly produced, angular.

Test marked by regular, even, concentric striæ, which, when well preserved, are elevated and lamellose, and are crowded and fasciculate on the anterior end of the shell.

Interior unknown.

A nearly entire left valve has a greatest length of 45 mm., height 20 mm., and hinge-line 26 mm. A similar right valve has a length of 37 mm., height 18 mm., and hinge-line 22 mm.

This species is very similar to *L. Lichas*, but differs in the greater convexity of body, undefined byssal depression, and narrower wing.

Formation and locality. In the middle portion of the Chemung group at Mansfield, Tioga county, Pa.

LEPTODESMA LICHAS.

PLATE XXI, FIGS. 35-39; AND PLATE XCI, FIGS. 19, 20.

Leptodesma Lichas, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 21, figs. 35-39. Jan., 1883.

SHELL of medium size, sub-rhomboidal; body sub-cylindrical, very oblique; length nearly twice the height; ante-byssal margin subtruncate, extending below to the broad, gently curving base; posterior margin abruptly recurved.

Valves very convex above, gently convex toward the posterior extremity, making the body somewhat cylindrical. Right valve probably a little shorter than the left, as inferred from the separated valves.

Hinge-line straight, less than the length of the shell.

Beaks acute, situated at the anterior third of the hinge-line, directed forward, prominent, arching over the cardinal line. Umbo abruptly gibbous, subtending an acute angle.

Anterior end large, acute and nasute at the extremity. The byssal sinus makes only a slight depression in the margin. Wing narrow-triangular, joining the body near the posterior extremity, not distinctly limited; margin straight and oblique below, recurving just beneath the hinge-line, and forming a short mucronate extension.

Test thin, marked by fine concentric striæ which are irregularly crowded into fascicles, producing an undulated aspect to the surface. The striæ are sub-lamellose on the anterior side, and sometimes fasciculate on the wing. The fascicles on the body are often marked on their summits by sharp, regular lamellæ. The structure as seen in exfoliated specimens is radiated; but this does not appear to be an exterior character.

The hinge is marked by a single narrow groove; beyond this the characters of the interior are unknown.

A large left valve has a length of 45 mm., height 25 mm., hinge-line 27 mm. A smaller specimen has a length of 28 mm., height 16 mm., hinge-line 17 mm. A right valve has a length of 26 mm., height 15 mm., and hinge-line 15 mm.

Formation and localities. In the Chemung group at Philipsburg, Alleghany county, N. Y., and in Sullivan township, Tioga county, Pa.

LEPTODESMA QUADRATUM, n. sp.

PLATE XCI, FIG. 15.

SHELL of medium size, rhomboidal or sub-quadrate; body ovate, making an angle of nearly 40° with the cardinal line; length one-third greater than the height; ante-byssal margin nearly vertical in front, rounding below into the shallow sinus, and extending nearly the whole height of the valve; ventral margin nearly straight; post-basal margin abruptly rounded and joining the wing without limitation.

Left valve convex, gibbous on the umbo, and obscurely angular along the posterior slope. Right valve equally convex.

Hinge-line straight, equal to three-fourths the length of the valve, and equal to the height.

Beaks situated at the anterior third of the hinge, prominent and arching over the cardinal line. Umbonal region gibbous, subtending an acute angle.

Anterior end convex, limited by a shallow, oblique, byssal depression which is nearly as long as the height of the valve; length one-half the height; extremity slightly produced. Wing triangular, scarcely defined, joining the body at the posterior extremity; margin oblique, straight or slightly convex; extremity obtuse-angular. An imperfect right valve presents about the same characters of wing.

Test marked by fine striæ of growth which are strongly fasciculate on the anterior end.

Interior unknown.

A left valve has a greatest length of 31 mm., height 20 mm., and hinge-line 21 mm.

This species is distinguished by its short, broad, sub-quadrate form. It has very much the aspect of MODIOMORPHA, but clearly belongs with *L. Phaon* and *L. Lichas*, which are among the extreme variations of the species of LEPTODESMA.

Formation and locality. In the Upper Chemung group, Lindley township, Steuben county, N. Y.

SECTION *f*, *mytiloidea.*

LEPTODESMA ACUTIROSTRUM, n. sp.

PLATE XCI, FIG. 21.

SHELL of medium size, rhomboid-ovate; body narrowly ovate and rapidly attenuate toward the beak, oblique, making an angle of a little less than 45° with the hinge-line; length nearly one-third greater than the height; ante-byssal margin oblique, sloping into the shallow sinus; broadly rounded below, the curvature continued into the posterior extremity.

Left valve depressed-convex in the lower part, moderately convex in the middle, and slightly gibbous above. Right valve unknown.

Hinge-line straight, less than the height of the valve.

Beak anterior, acute, directed forward, scarcely rising above the hinge-line. Umbonal region narrow and moderately gibbous, subtending a very acute angle.

The byssal depression reaches the margin just below the beak, leaving a very small, acute, anterior extremity. Wing large, undefined, joining the body at the posterior end; margin oblique, essentially straight, not recurved at the cardinal extremity.

Test thin, leaving upon the cast the marks of the striæ of growth which are more or less fasciculate upon the body, and crowded and lamellose in front.

Hinge furnished with a distinct posterior tooth. Interior unknown.

The specimen described has a length of 32 mm., height 24 mm., and hinge-line 22 mm.

This species somewhat resembles *L. Orodes*, especially as shown in Pl. xxv, fig. 10, but the beak is more nearly anterior, the anterior end much smaller and more acute, the byssal sinus not extending so low on the body of the valve, and the body of the shell more distinctly attenuate toward the beak. It is especially distinguished by its narrow slender beak and small anterior end.

Formation and locality. In a sandstone of the Upper Chemung group at Warren, Pa.

Leptodesma mytiliforme.

PLATE XXV, FIGS. 7, 11; AND PLATE XCI, FIGS. 22–25.

Leptodesma mytiliforme, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, figs. 7, 11. Jan., 1883.

Shell of medium size, elongate-ovate; body narrowly elliptical, becoming attenuate in front, oblique, making an angle of nearly 45° with the hinge-line; length more than one-third greater than the height; ante-byssal margin oblique, gently curving into a scarcely perceptible sinus, giving a straight or slightly concave margin extending for two-thirds the length of the valve; posterior margin abruptly rounded.

Left valve regularly convex in the lower half, becoming contracted, gibbous and sub-angular above the middle. The right valve is smaller, the hinge-line proportionally longer, the base of the valve and the wing much more depressed, and the umbonal region narrow and more angular.

Hinge-line straight, about equal to the height of the valve.

Beaks sub-anterior, directed forward, acute, scarcely raised above the hinge-line. Umbonal region narrow and gibbous, subtending a very acute angle.

Anterior end short, abruptly attenuate, acute, limited by a shallow byssal depression which extends for half the length of the valve. Wing large, not strongly limited, extending nearly to the posterior extremity of the body; margin very oblique, not concave, nor recurved below the cardinal line; extremity obtuse-angular.

Test thin, marked by concentric striæ which have left their impression upon the cast of the interior, showing them to have been regular upon the body and wing, and crowded into fascicles upon the anterior side.

Ligamental area narrow and finely striated. Interior unknown.

The largest specimen of the left valve observed has a length of 48 mm., height 25 mm., and hinge-line 22 mm. A smaller example has a length of 33 mm., height 22 mm., and hinge-line 20 mm. A large right valve has a length of 40 mm., height 25 mm., and hinge-line 27 mm.

This species differs from *L. Mentor* in its proportionally longer, narrower and sub-angular body, the smaller, less defined wing, the less distinct byssal sinus, and the smaller anterior end. The wing is often imperfect, giving the shell much the aspect of MYTILUS or MODIOLA. The axis of the shell in the left valve is apparently slightly curved, giving it a characteristic expression.

Formation and locality. In a coarse sandstone of the Upper Chemung group, on the road from Olean, N. Y., to Smethport, Pa.

PTERONITES, McCoy.

Pteronites profundus.

PLATE XXII, FIGS. 25, 26, 27.

Pteronites profundus, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, figs. 25–27. Jan., 1883.

Shell large, longitudinally semi-ovate; body semi-elliptical, arcuate, oblique to the hinge-line at an angle of about 30°; length about twice the height; anterior margin very oblique, slightly concave beneath the beak and gradually curving into the broadly rounded basal margin; posterior margin obliquely truncate, slightly curving below.

Left valve convex in the lower part, gibbous from the middle upwards. Right valve unknown.

Hinge-line straight; length more than the greatest length of the shell.

Beak sub-anterior, obtuse, rising but little above the hinge-line, and apparently not incurved. Umbonal region very gibbous, subtending an acute angle.

Anterior end produced into an acute extension which is limited by a very shallow byssal depression. Wing not defined, extending from the beak the entire length of the shell, and produced beyond the posterior extremity of the body; margin very slightly concave, extending at nearly right angles to the axis of the body.

Test of moderate thickness, marked by concentric striæ. The casts show distant, irregular, concentric undulations.

Hinge with a single continuous groove. The pallial line extends parallel to the ventral margin, from a point anterior to the beak to below the middle of the length of the body.

A large left valve has a length of 78 mm., with a height of 38 mm., and hinge-line 90 mm. A smaller example has a length of 37 mm., height 23 mm., and hinge-line 40 mm.

All the specimens of this species are casts of the interior, with the single exception of an individual which preserves the test very imperfectly. The concentric undulations of the cast are often a conspicuous feature, and the umbonal slope is occasionally obtusely subangular. The wing follows the general contour and convexity of the valve.

Formation and localities. In the Upper Chemung group, associated with *Spirifera Verneuili* near Olean, Alleghany county; in the vicinity of East Randolph, and other places in Cattaraugus county, N. Y.

PTERONITES ROSTRATUS.

PLATE XXII, FIG. 24.

Pteronites rostratus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 22, fig. 24. Jan., 1883.

SHELL of medium size, broadly semi-ovate; body oblique at an angle of about 45° to the hinge-line; length nearly twice the height; ante-byssal margin oblique, gently curving into the broadly rounded basal margin; posterior margin somewhat obliquely truncate.

Left valve depressed-convex below, convex in the middle, and somewhat gibbous above. Right valve unknown.

Hinge-line straight; length greater than the greatest length of the shell.

Beak sub-anterior, sub-acute, prominent. Umbonal region moderately gibbous, subtending an acute angle.

Anterior end nasute. Wing not defined, in direct continuation of the convexity of the body, extending to the posterior extremity; margin very slightly concave, oblique to the cardinal line, slightly produced at the extremity.

Test ornamented by fine, elevated, concentric striæ, which are continued over the body and wing without interruption, becoming crowded and somewhat fasciculate on the anterior side and on the nasute extension in front.

The umbonal region shows a few concentric undulations, which are not continued to the middle of the length of the valve.

Interior unknown.

The specimen described has a length of 29 mm., height 16 mm., and hinge-line 31 mm.

This species is much smaller than *P. profundus*, less elongate and less gibbous in its proportions. The beak is apparently more elevated and angular, but the angularity of the umbonal region is not continued along the body as in the preceding form.

Formation and locality. In the shales of the Chemung group at Rockville, Alleghany county, N. Y.

PTERONITES INOPTATUS, n. sp.

PLATE LXXXVII, FIG. 5.

SHELL of medium size, broadly semi-ovate; body ovate, oblique, making an angle of about 25° with the cardinal line; ventral and basal margins broadly rounded; post-basal extremity abruptly recurved.

Left valve regularly convex, slightly gibbous above. Right valve unknown.

Hinge-line straight, less than the greatest length of the shell.

Beak sub-anterior, directed forward, prominent and incurved over the cardinal line. Umbonal angle acute.

Anterior end short, nasute; extremity acute. Wing very narrow-triangular, scarcely defined, joining the body at the posterior extremity; margin oblique, in direct continuation with the posterior extremity and curving backward just beneath the cardinal line; extremity acute.

Test marked by concentric striæ of growth which are strongly fasciculate on the anterior end and ventral margin.

Interior unknown.

The left valve described has a length of 38 mm., height 21 mm., and hinge-line 33 mm.

This species is distinguished from the other forms of this genus by its narrow wing and shorter hinge-line. It has the characteristic aspect of PTERONITES although approaching, in several particulars, to some species of LEPTODESMA.

Formation and locality. In the Chemung group, Mansfield, Tioga county, Pa.

PALÆOPINNA, HALL.

PALÆOPINNA FLABELLA.

PLATE XXV, FIG. 18; AND PLATE LXXXVII, FIG. 4.

Palæopinna flabella, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, fig. 18. Jan., 1883.

SHELL large, broadly semi-ovate, gaping at the anterior extremity; axis oblique to the hinge at an angle of about 30°; length nearly twice the height; byssal margin abruptly truncate; ventral margin very broadly curving; posterior margin oblique, sub-truncate.

Left valve depressed-convex in the posterior and ventral portions, becoming more convex above and moderately gibbous in the umbonal region. Right valve unknown.

Hinge-line straight, equalling the greatest length of the shell.

Beak anterior, terminal, prominent, directed forward, scarcely rising above the cardinal line. Umbonal region subtending an acute angle.

Anterior end abruptly truncate; margin excavate. Wing continuous with the body of the shell without limitation or interruption; margin directed backward, nearly straight, continuous with the post-basal margin of the body; extremity abruptly rounded.

Test thin, marked by regular concentric striæ of growth which are cancellated by fine sub-equal radii; in the cast the concentric and radiating striæ are of nearly equal strength. On the anterior end the radii are obscure or obsolete as preserved in the cast.

Ligamental area narrow, marked by a single longitudinal groove and a slight oblique furrow extending backward from the beak a little more than one-third the length of the hinge.

The left valve described has a length along the hinge-line of 80 mm., height 40 mm.; measured along the axis of the body the length is about 70 mm., and the anterior truncation is 25 mm. long.

The specimen described is a cast of the interior, preserving the surface markings in a subdued condition. The anterior margin appears to have been slightly incurved and the truncation resembles that in some forms of Solen.

Formation and locality. In the Oriskany sandstone, Schoharie, N. Y.

Palæopinna recurva.

PLATE XXV, FIG. 19.

Palæopinna recurva, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 25, fig. 19. Jan., 1883.

Shell large, elongate semi-elliptical; axis making an angle with the hinge-line of from 20°–25°; length greater than twice the height; basal margin very broadly curving; posterior margin rapidly rounding and recurving toward the beak.

Left valve depressed-convex below, convex above and becoming gibbous toward the beak. Right valve unknown.

Hinge-line straight, not extending as far as the posterior extremity.

Anterior end unknown. Wing not defined; margin continuous with the post-basal margin and abruptly incurving at the extremity.

Test thin, marked by fine sub-equal striæ of growth, which become lamellose on the pallial margin; and by radii of unequal strength, which are are sometimes strongly crenulated by the concentric striæ. Anterior to the middle of the shell the radii are obscure.

Interior unknown.

The specimen described is imperfect on the anterior end but preserves a length of 120 mm., and a height 62 mm.

This species differs from the preceding in its larger size, broadly rounded posterior extremity, and the hinge not extending as far as the posterior margin; the body is also more oblique and less convex.

Formation and locality. In limestone of the Upper Helderberg group, Stafford, Genesee county, N. Y.

ECTENODESMA, Hall.

Ectenodesma birostratum.

PLATE XXIII, FIGS. 27-30; AND PLATE LXXXIV, FIG. 20.

Ectenodesma birostratum, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 23, figs. 27-30. Jan., 1883.

Shell large; body ovate, oblique; height greater than the length; margin regularly curving from the base of the anterior wing to the post-basal margin, where it is somewhat abruptly recurved.

Left valve regularly convex below, gibbous in the umbonal region, somewhat arcuate, the point of greatest convexity being about the middle of its length. Right valve concave below, depressed-convex in the middle, convex on the umbo.

Hinge-line straight, much longer than the length of the shell, and, in extreme specimens, more than once and a half greater than the length of the shell.

Beaks acute, anterior to the middle of the shell, inclined forward, and arching over the hinge-line. Umbonal region gibbous, limited on the anterior side by a shallow undefined sulcus, and on the posterior side by the abrupt depression of the body, subtending an acute angle.

Anterior wing large, triangular; margin concave; extremity produced to an acuminate extension. Byssal sinus shallow and undefined. Posterior wing large, triangular, joining the body below the middle of its height; margin concave; extremity produced into an acute termination.

Test of left valve marked with regular and even radii which are rounded above, flattened and sometimes bifurcate below; similar but more acute radii continue over the posterior wing. In the right valve the rays are more numerous, finer and sharp, and are continued upon the posterior wing with a little less force than on the body of the shell; and very much subdued upon the anterior wing; entire surface marked by fine, even, concentric striæ of growth.

The specimens show an oblique lateral tooth, with obscure indications of anterior teeth or folds. Ligamental area narrow, marked with fine parallel striæ.

A left valve has a length of 45 mm., height 50 mm., hinge-line, when entire, about 75 mm. A small right valve has a length 34 mm., height 27 mm., hinge-line about 45 mm.

This species is distinguished by the great and nearly equal extent of the hinge-line on both sides of the beak; by the peculiar form of the body of the shell; and by its surface characters, which are unlike any yet observed.

Formation and localities. In the Chemung group at Franklin, Delaware county; and a right valve referred to this species is from a point four miles above Chenango Forks, Chenango county, N. Y.

LIMOPTERA, Hall.

Limoptera pauperata.

PLATE XXVI, FIG. 5.

Limoptera pauperata, Hall. Prelim. Notice Lam. Shells, etc., pt. 2, p. 16. Dec , 1869.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 26, fig. 5. Jan., 1883.

Shell large; body ovate, sub-erect; wing greatly expanded; height much greater than the length; basal margin broadly rounded; posterior side gently curving from the post-basal extremity to the beak.

Left valve somewhat regularly convex from the umbo to the base. Right valve unknown.

Hinge-line straight, longer than the greatest length of the valve.

Beak of the left valve prominent, inclined forward, rising above the hinge-line, situated anterior to the middle of the body of the shell. Umbonal region moderately gibbous, abrupt on the anterior, and more gently sloping on the posterior side.

Auricle and byssal sinus unknown. Wing large, triangular, not distinctly limited from the body, and extending nearly to the post-basal extremity of the shell; margin slightly concave; extremity abrupt (rectangular?).

Test marked by strong rounded radii, with alternate smaller ones; or finer bifurcating rays between, which are somewhat curved as they approach the beak. The entire surface of the shell is marked by fine concentric striæ, which become crowded and lamellose, obscuring and partially obliterating the rays; the striæ on the lower part of the body are conspicuous, and also on the wing and especially toward the hinge-margin. In the cast the rays show a somewhat nodose character which is probably due to the unequal weathering of the concentric lamellæ.

Interior characters and ligamental area unknown.

The specimen described has an approximate height of 75 mm., and a length of 65 mm. (The figure is incorrect in its proportions.)

This species differs from *L. macroptera*, and from *L. cancellata*, in its lesser gibbosity and its much stronger radii. A single, ill-preserved, specimen from the Hamilton group, possesses characters similar to this species, but the identity of the two cannot be positively determined without more material.

Formation and locality. In the higher beds of the Upper Helderberg limestone at Stafford, Genesee county, N. Y.

LIMOPTERA CANCELLATA.

PLATE XXVI, FIGS. 1-4; AND PLATE XCII, FIGS. 1-3.

Limoptera cancellata, HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 16. Dec., 1869.
" " " MILLER, Cat. Amer. Pal. Foss., p. 193. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 26, figs. 1-4. Jan., 1883.
Limoptera cancellata, var. occidens, H. AND W. Twenty-Fourth An. Rep., N. Y. State Museum Nat. Hist., p. 199, pl. 11, figs. 12-15. 1872.

SHELL large; body sub-erect, broadly ovate; axis nearly vertical to the hinge-line; wing expanded; height and length nearly equal; ventral margin very broadly rounded; anterior margin expanded below and contracted above; post-basal side expanded, recurving somewhat abruptly and extending in a sub-arcuate line to the beak.

Valves very unequal. Left valve moderately convex below, gradually becoming gibbous and arcuate above. Right valve concave below, flat in the middle and depressed-convex in the umbonal region.

Hinge-line straight, less than the length of the valve.

Beak of left valve prominent, anterior to the middle of the valve, acute, inclined forward and arching over the hinge-line. Umbonal region prominent, gibbous, abruptly limited on either side. In the right valve the beak does not rise above the cardinal line. Umbonal region defined on the anterior side by a distinct oblique fold or ridge, and on the posterior side by a well-marked depression limiting the wing, subtending an acute angle.

Ear small, limited by a shallow sinus below. Wing large, triangular, extending more than half the height of the shell toward the base; margin gently concave and slightly recurving toward the hinge-line; extremity angular.

Test of moderate thickness, marked by somewhat distant, rounded, abruptly elevated radii, with wider intermediate flat spaces which are sometimes marked by one or more smaller rays. In the partial cast, these rays are crossed, and the intermediate spaces cancellated, by fine concentric striæ. Towards the ventral and baso-lateral margins the shell is lamellose and the radii become obsolete. The concentric striæ are crowded upon the wing, and the radii are less conspicuous than on the body of the shell.

Ligamental area in left valve large; smaller in the right valve. The pallial line in the left valve forms a distinct nodose ridge, which extends from the rostral cavity in a slightly arcuate line to below the middle of the valve. In the right valve, the pallial line in the cast extends along the ridge, limiting the body of the shell from the anterior alation. In the cast of the left valve, the umbonal cavity is marked by numerous nodes indicating pits in the shell for muscular attachment. The posterior muscular impression is large, occupying the post-umbonal slope at a point about half-way from the beak to the base of the shell.

A cast of the interior has a length of about 78 mm., height 77 mm., and hinge-line less than the length of the shell.

This species is distinguished by its erect form, the broad flat interspaces between the radii, and the regular sharp concentric striæ.

Formation and locality. The specimen is from the higher beds of limestone at the Falls of the Ohio, which are of the age of the Hamilton group.

LIMOPTERA MACROPTERA.

PLATE XXIV, FIG. 14; PLATE XXVI, FIGS. 6-9; PLATE XXVII, FIGS. 1-10; PLATE XXVIII, FIGS. 4, 5; PLATE XXIX, FIGS. 1-4; AND PLATE XCII, FIGS. 4-9.

Lima macroptera, CONRAD. Annual Report N. Y Geolog. Surv., p. 117. 1838.
Limoptera macroptera (CONRAD), HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 17. Dec., 1869.
" " " S. A. MILLER, Cat. Amer. Pal. Foss. 1877.
" " " HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 24, fig. 14; pl. 26, figs. 6-9; pl. 27, figs. 1-10; pl. 28, figs. 4, 5; and pl. 29, figs. 1-4. Jan., 1883.

SHELL large; including the cardinal expansions, the form is subquadrate; body broadly ovate, erect or moderately oblique; wing more or less expanded; height one-fourth to one-third greater than the length; basal margin broadly rounded, with the anterior and posterior sides sub-parallel.

Valves very unequal. Left valve ranging from moderately convex to very gibbous, often somewhat regularly arcuate from beak to base. Right valve smaller than the opposite, in young specimens nearly flat below, depressed-convex in the middle, and more convex in the umbonal region; in specimens of medium size there is often a greater convexity in the upper part, and in very old specimens the surface is depressed-convex and nearly flat in the lower part.

Hinge-line straight, sometimes equalling but usually less than the length of the shell.

Beak of the left valve prominent, acute, inclined forward, rising above and arching over the cardinal line, situated anterior to the middle of the body of the shell. Umbonal region prominent, convex in young shells and gibbous in older ones, limited anteriorly by a distinct sulcus, and posteriorly by the abrupt umbonal slope. Beak of right valve acute, scarcely rising above the hinge-line, defined anteriorly by the byssal sulcus, and posteriorly by the abrupt depression and distinct limitation of the wing. Umbonal angle acute.

Ear small, well-defined in young specimens, and scarcely increasing in size in proportion to the growth of the shells, limited by a distinct byssal depression; extremity rounded. Wing large, triangular; margin more or less concave in young shells, and often nearly straight in older shells; extremity produced or rectangular, often extending beyond the posterior margin of the valve.

Test thick, especially in the umbonal region; marked by distinct subequidistant, rounded radii, with slightly concave interspaces, in which are often finer, or obscurely developed rays; the right valve is usually more closely and less strongly marked by them than the left. The radii are crossed and crenulated by elevated, lamellose, concentric striæ, which are more distant and conspicuous on the right valve. In the young shells, the radii are conspicuous on the wing; they are a little more distant than on the body of the shell, and often obsolete along the line of the junction of the wing with the body, especially in the right valve. In both valves, the radii become obscure or obsolete below the centre, and the surface is marked by strong, irregular, concentric, lamellose undulations. The radii often become more or less obsolete upon the wing, while remaining conspicuous on the body of the shell.

Ligamental area extending the entire length of the hinge-line, much wider in the left valve; marked by coarse parallel, undulating, longitudinal grooves or striæ. There is a conspicuous oblique posterior lateral tooth, and two strong cardinal folds beneath or just anterior to the beak. Anterior muscular impression situated in the rostral cavity; the pallial line continues thence in a curve somewhat parallel to the margins of the shell, turning inward below the middle of the height and joining the large muscular impression.

The right valve of a young individual (plate xxiv, fig. 14) has a length of 30 mm., height 35 mm., and hinge-line 32 mm. The margin of the left valve, which remains in the matrix, shows it to have had a length of 42 mm., and a height of 53 mm. Another specimen, with the two valves attached, has the left valve 75 mm. and the right valve 55 mm. in height, while the length of the two valves respectively is 63 and 43 mm. In another specimen (plate xxvii, figs. 6 and 7), where the two valves are in juxtaposition, there appears to be little difference in the relative dimensions, but this appearance is in a great measure due to the fact that the margins of the left valve have been broken away to the line of junction of the two valves. The proportional dimensions of the left valves are subject to much variation, as is shown in plate xxvii, figs. 2 and 3.

The measurement of two large specimens gives respectively, length 78 and 74 mm., height 90 mm. each, and hinge-line 58 and 65 mm. A large specimen with the margin imperfect has a length of 88 mm., and height 112 mm. A separated right valve has a length of 97 mm., height 103 mm., and hinge-line 84 mm.

The young shells of this form, especially the right valves, might readily be mistaken for *Aviculopecten* or *Pterinopecten;* but a critical examination will show the radii to be peculiar and characteristic of the genus.

The form and proportions of the fossil are subject to great variations in their natural conditions, but the variation and distortions of form, consequent upon the degree and direction of pressure from the inclosing matrix, produces much greater extremes. Some of the distorted forms are illustrated on plates xxviii and xxix. In the older specimens, the obliteration or obsolescence of the radii below the middle of the valve, gives a great variety of aspect to the fossil. These variations are illustrated on plates xxvi, xxvii and xxviii.

In all the younger specimens, the wing is produced, and the margin sinuate, while the surface is distinctly marked by the radii. These features are gradually lost as the shell advances in age, until the margin of the wing becomes nearly or quite direct, the extremity of the wing obtuse, and the surface marked only by the concentric striæ of growth. In old specimens the ear is often obscure, and scarcely retains the proportionate size of that appendage in the younger shells.

Formation and localities. In the Hamilton group, at Cazenovia and other localities in Madison county, and in Otsego and Onondaga counties, N. Y.

LIMOPTERA OBSOLETA.

PLATE XXIX, FIGS. 5, 6; PLATE XXVI, FIG. 10?; AND PLATE XCII, FIG. 10.

Limoptera obsoleta, HALL. Prelim. Notice of Lam. Shells, etc., pt. 2. Dec., 1869.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 29, figs. 5, 6. Jan., 1883.

SHELL large; body ovate, erect or slightly oblique; height greater than the length; basal margin regularly rounded; anterior side broadly convex and contracting to the byssal sinus; posterior side abruptly recurved from the base, and extending in a nearly direct or slightly concave line to the extremity of the wing.

Valves very unequal. The right valve much depressed or nearly flat; the left valve depressed-convex below, regularly convex in the middle, and gibbous in the umbonal region.

Hinge-line straight, nearly rectangular to the axis of the body of the shell, less than the length of the valve.

Beak of left valve prominent, acute, inclined forward, situated anterior to the middle of the body, rising much above the beak of the right valve, and arching over the cardinal line. Umbonal region prominent, and sometimes gibbous, limited anteriorly by a distinct broad depression, and posteriorly by the abrupt umbonal slope; subtending an acute angle.

Ear small, limited by the byssal sinus. Wing moderately large, triangular, extending below the middle of the length of the body; extremity abruptly rounded.

Test thick, marked by irregular concentric striæ of growth, which are crowded and strongly lamellose on the lower half of the body and on the anterior and posterior sides. On the wing, just below the cardinal line, the striæ turn gently outward. In some specimens there remain obscure indications of radii.

Ligamental area wide, extending the entire length of the hinge-line; marked by coarse undulating striæ and wider intermediate grooves. Other characters of the hinge and interior not observed.

One of the specimens figured has a height of 88 mm., and another of 100 mm.; the approximate length is 70 mm. and 88 mm., respectively. Another specimen has a length of 77 mm., and a height of 90 mm. A larger specimen has a length of 90 mm., and a height of 100 mm.

The specimens of this species occur in the softer shales of the Hamilton group, and it is possible that long maceration has had some influence in obliterating the radii; but *L. macroptera*, with its more convex form, and marked by its characteristic radii, occurs in the same localities. Although not entirely satisfied in regard to its specific distinction, it may be convenient to separate this at least as a varietal form.

Formation and localities. In the Hamilton group, at Hamilton, Madison county, at Delphi, Onondaga county; and on the shore of Cayuga lake, N. Y.

LIMOPTERA CURVATA.

PLATE XXVIII, FIGS. 1-3.

Limoptera curvata, HALL. Prelim. Notice, Lam. Shells, etc., part 2, p. 18. Dec., 1869.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 28, figs. 1-3. Jan., 1883.

SHELL large, sub-rhomboid-ovate in outline; body broadly ovate, arcuate, expanded on the antero-basal margin.

Valves very unequal. Left valve very gibbous in the middle and umbonal region. Right valve depressed-convex below, becoming somewhat gibbous on the umbo. Left valve, with the beak, very prominent and incurved; beak of right valve rising but little above the hinge-line.

Test thick, marked by strong rounded radii with intermediate finer lines which become obsolete on the lower part of the valve. The radii are crossed by fine, closely arranged striæ of growth, which at intervals are crowded and lamellose, especially toward the margin of the valve.

The internal cast shows the anterior muscular impression situated at the extremity of the rostral cavity, from which the pallial line, marked by a row of strong pustules, extends nearly parallel to the anterior margin for more than one-third the length of the valve; thence broadly curving, it extends below the middle of the valve, and recurves into a large sub-circular muscular impression on the post-umbonal slope. The interpallial area is finely pustulose.

This variety was originally separated from *L. macroptera* by reason of its proportionally broader, shorter, and more gibbous form; the arcuation of the body of the left valve, and its expansion on the antero-basal margin. In a single example of the left valve, the radii are much stronger than usual in typical specimens of the other form, and the interstitial radii more strongly developed. These characters, and others upon which the species was originally founded, when compared with a large number of individuals of the genus, are represented with many modifications, and the specific distinction is here continued with much reservation.

On comparing the typical specimen of Mr. Conrad's *L. macroptera*, we find it proportionally shorter and wider than many specimens since referred to the same species; measuring 63 mm. in length and about 78 mm. in height, the left valve very gibbous and the body sub-arcuate; the proportions being very nearly the same as in *L. curvata*, represented in fig. 2, of plate xxviii.

Formation and localities. This species occurs in the Hamilton group at Cazenovia and other places in Madison county, N. Y.

BYSSOPTERIA, HALL.

BYSSOPTERIA RADIATA.

PLATE XXXII, FIGS. 21, 22; AND PLATE LXXX, FIG. 11.

Mytilarca radiata, HALL. MS. 1877.
" " " S. A. MILLER. Cat. Amer. Pal. Fossils. 1877.
Byssopteria radiata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 32, figs. 21, 22; pl. 80, fig. 11. Jan., 1883.

SHELL large, wide-triangular, alate posteriorly; body undefined; length about five-sevenths of the height; anterior margin vertically truncate the entire height of the shell; basal and posterior margins broadly rounded.

Valves sub-equal, depressed-convex on the basal and post-basal sides, sub-angularly gibbous on the umbo and along the anterior side.

Hinge-line straight, less than the length of the shell. Beaks anterior, acute, elevated, and directed forward. Anterior end sub-nasute.

Test marked by strong, sub-equal, rounded radii which are wider than the interspaces, often bifurcating below the middle of their length, and on the outer portion of the undefined wing they are fasciculate and finer. Entire surface marked by striæ of growth which become elevated into fascicles toward the margins.

Interior unknown.

A right valve has a length of 55 mm. and height 72 mm. A left valve measures 54 mm., in length, and 79 mm., in height.

This species is unlike any Pectinoid or Aviculoid form described in this volume, and has somewhat the aspect of several species of AMBONYCHIA from the lower rocks, although probably very distinct in its generic relations.

Formation and locality. In the Upper Chemung group at Mansfield, Tioga county, Pa.

MYTILARCA, Hall.

Sub-Genus PLETHOMYTILUS, Hall.

Mytilarca (Plethomytilus) arenacea.

PLATE XXX, FIG. 1; AND PLATE LXXXVII FIG. 10.

Mytilarca arenacea, Hall.	Prelim. Notice Lam. Shells, etc., pt. 2, p. 20. Dec., 1869.
" " "	S. A. Miller in Cat. Amer. Pal. Foss. 1877.
Plethomytilus " "	Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 30, fig. 1. Jan., 1883.

Shell of medium size; body ovate, acute at the apex, slightly oblique; height equal to about three-fourths of the length. Byssal area concave; margin straight below to a point three-fourths of the length from the apex; abruptly curving to the posterior and basal margins; post-basal and dorsal margins gently curving to the extremity of the hinge-line.

Valves moderately convex below, becoming gibbous in the umbonal region, and upon the anterior umbonal slope.

Hinge-line straight and short. Beaks anterior, prominent, rising above the cardinal line, moderately incurved. Umbonal angle acute. Posterior alation narrow and short, merging into the general contour of the margin above the middle of the length of the shell.

Test thick, marked by fine concentric striæ of growth, which at somewhat regular intervals are crowded, and raised into imbricating lamellæ, as shown in casts of the interior.

A valve of the ordinary size measures about 60 mm. in length, and 45 mm. in its greatest height.

The fossils of this species are known only as casts of the interior, in an arenaceous matrix, and are usually more or less imperfect, the narrow posterior alation being rarely preserved in connection with the body of the shell.

Formation and localities. In the Schoharie grit at Schoharie, and in the Helderberg mountains, Albany county, N. Y.

MYTILARCA (PLETHOMYTILUS) PONDEROSA.

PLATE XXX, FIGS. 2-7.

Mytilarca ponderosa, HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 21. Dec., 1869.
" " HALL. S. A. MILLER, Cat. Amer. Pal. Foss. 1877.
Plethomytilus ponderosus, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 30, figs. 2-7. Jan., 1883.

SHELL very large; body acutely ovate, erect; height three-fifths the length;* ventral margin nearly straight or slightly concave for about one-half the length of the shell; posterior and basal margins abruptly rounded; dorsal margin gently curved to the extremity of the hinge-line.

Valves equal, regularly convex posteriorly, gibbous above and in the umbonal region.

Hinge-line straight and short. Beaks anterior, prominent, rising much above the cardinal line, moderately incurved. Ventral side concave with a slight inflation of the margin at the byssal opening. Dorsal side sub-alate.

Test thick, marked by concentric striæ of growth which become lamellose toward the margin.

Ligamental area finely and evenly striated longitudinally, in old shells becoming very wide, indicating great thickness of the test.

Interior unknown.

A large specimen, which is a cast of the interior, has a length of 135 mm., height 80 mm., breadth 80 mm. A small example has a length of 36 mm. and height 23 mm.

This species differs from *Mytilarca* (*P.*) *arenacea* in its greater size and gibbosity; from *M.* (*Plethomytilus*) *cordiformis*, HALL=*M.* (*P.*) *myilimera*, CONRAD, and *M* (*P.*) *ovata*, HALL, from the Lower Helderberg group, in its more elongate form and more attenuate apex.

Formation and localities. In the limestone of the Upper Helderberg group, Helderberg mountains, Albany county, N. Y.; Clarence Hollow, Erie county, N. Y.; and in limestone of the same age at Columbus, Ohio, and Walpole, Ontario.

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*In the mytiloid forms the length is measured from the beak to the posterior extremity and the height is at right angles to this. The breadth represents the convexity of the valves.

MYTILARCA (PLETHOMYTILUS) OVIFORMIS.

PLATE XXXI, FIGS. 1-8; AND PLATE LXXXVII, FIG. 8.

Inoceramus oviformis, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. viii, p. 246, pl. 13, fig. 7. 1842.
Mytilarca oviformis (CONRAD), HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 21. 1869.
Plethomytilus oviformis (CONRAD), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 31, figs. 1-8. Jan., 1883.

SHELL large; body ovate, erect, wide posteriorly and acute above; length about one-fifth greater than the height; ventral margin for nearly half the length of the shell nearly direct, thence gently curving into the posterior extremity which is broadly rounded; dorsal margin very gently curved.

Valves equal, regularly convex in the posterior part, becoming gibbous in the umbonal region.

Hinge-line straight, less than the height of the shell. Beaks prominent, anterior acute, and incurved, rising above the cardinal line.

Ventral side truncate with a small fold for the passage of the byssus. Dorsal side sub-alate.

Test thick, marked by fine, close striæ of growth which at intervals are fasciculate and raised into lamellose elevations and very much crowded and elevated on the ventral side of the shell.

Ligamental area wide, finely striated longitudinally and occasionally preserving one or two oblique folds which may have been lateral teeth. Other characters of the interior unknown.

A large specimen has a length of 74 mm. and height 55 mm. A small example measures 25 mm. in length and 17 mm. in height.

This form differs from *M. (P.) ponderosa* in its greater proportional height, smaller size, and lesser gibbosity.

Formation and localities. In the shales of the Hamilton group at numerous localities in Schoharie, Otsego, Onondaga, Ontario, Livingston and Erie counties, N. Y.

MYTILARCA (PLETHOMYTILUS) KNAPPI, n. sp.

PLATE LXXXVII, FIG. 13

SHELL of medium size; body ovate, obtuse, broad below; height nearly equal to the length; ventral margin rounded with a slight sinuosity at the byssal opening; dorsal margin broadly rounded.

Right valve moderately convex below, somewhat more convex in the umbonal region. Left valve unknown.

Hinge-line less than the height of the shell. Beak obtuse.

Test thin below, thicker on the upper part and cardinal line. Surface marked by fine, regular, elevated striæ of growth.

Ligamental area narrow, coarsely striated longitudinally.

Interior unknown.

The right valve described has a length of 48 mm. and height 44 mm.

This species differs from *M.* (*P.*) *oviformis* in its proportionally greater height, less attenuate beak, lesser convexity and the coarsely striated ligamental area. The relations of this species are somewhat obscure, owing to the obscure limitation of the beak and the effects of maceration and compression. It is however clearly distinct from any of the forms here described.

Formation and locality. In the shales of the Hamilton group on the shores of Skaneateles lake, N. Y.

MYTILARCA PYRAMIDATA.

PLATE LXXX, FIGS. 1 3.

Mytilarca pyramidata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 80, figs. 1–3. Jan., 1883.

SHELL of medium size; body sub-angularly ovate, pyramidal; length one-third greater than the height; ventral margin truncate and concave, curving abruptly into the basal margin; dorsal margin very gently curving to the beaks.

Valves equal, convex, gibbous above, and sub-angular along the anterior umbonal slope. The ventral side is rectangularly incurved.

Hinge-line short. Beaks acute, extremely elevated, directed slightly forward and curving over the cardinal line.

The test has not been preserved. The casts are nearly smooth, but showing lamellose striæ on the pallial margin.

Interior unknown.

A specimen of this species has a length of 36 mm., height 23 mm., breadth 22 mm.

This form is shorter, more gibbous, more attenuate towards the beak, and less rounded on the posterior side than *M. Chemungensis.*

Formation and locality. In the Schoharie grit, Schoharie county, N. Y.

MYTILARCA UMBONATA.

PLATE XXXII, FIGS. 1-7.

Mytilarca umbonata, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 32, figs. 1–7. Jan., 1883.

SHELL small to medium size; body ovate, acute above; length more than one-third greater than the height; ventral margin truncate, inflated at the byssal opening; basal margin abruptly rounded.

Valves equal, strongly convex in the lower part and narrowly gibbous in the umbonal region. Ventral umbonal slope obtusely angular, concave between this and the ventral margin. Dorsal side not alate.

Hinge-line short. Beaks acute, elevated, nearly vertical, arching over the cardinal line.

Test thin, marked by fine concentric lines of growth which become crowded and lamellose toward the pallial margin.

Interior unknown.

A specimen has a length of 33 mm., height 18 mm., breadth 19 mm.

This species differs from *M. Chemungensis* in its shorter and more gibbous form; the beaks more elevated and erect.

Formation and localities. In the Middle Chemung group, Ithaca, N. Y., and near Mansfield, Pa.

MYTILARCA CHEMUNGENSIS.

PLATE XXXII, FIGS. 8–11, 13, 14.

Inoceramus Chemungensis, CONRAD. Jour. Acad. Nat. Sci., Phila., vol. 8, p. 246, pl. 13, fig. 9. 1842.
Mytilus Chemungensis (CONRAD), PHILLIPS and SALTER. Memoirs Geolog. Surv. of Great Britain, vol. 2, pt. 1, p. 365, pl. 20, figs. 10, 11. 1848.
Mytilarca Chemungensis (CONRAD), HALL. Prelim. Notice Lam. Shells, etc., p. 23. 1869.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 32, figs. 8–14 (pl. 33, fig. 8, in error). Jan., 1883.

SHELL of medium size, much elongated from beak to posterior extremity; body narrow, elongate-ovate, sub-arcuate; length averaging twice the height but with considerable variation; ventral margin nearly straight, slightly concave for nearly three-fourths of the length; basal margin abruptly rounded; dorsal margin gently curving.

Valves equal, convex in the posterior part, gibbous above; the greatest convexity a little above the middle. The ventral umbonal slope is obtuse, sloping nearly vertically to the ventral margin.

Hinge-line short, oblique. Beaks elevated, acute, anterior, slightly incurved.

Test thin, marked by very fine concentric striæ, which toward the margins are often fasciculate and sub-imbricating.

Ligamental area finely striated longitudinally. Cardinal teeth small, diverging, situated immediately under the beak. Other characters of the interior unknown.

The proportions of length and height are subject to great variation. A short example has a length of 26 mm. and height 17 mm. A specimen of ordinary proportions has a length of 53 mm. and height 26 mm. An elongate form has a length of 56 mm. and height 22 mm.

This species differs from *M. carinata* in its comparatively longer form; the ventral umbonal slope less angular; and the body less arcuate.

Formation and localities. In the middle portion of the Chemung group, Rockville, Hobbieville and Phillipsburgh, Alleghany county, and East Randolph, Cattaraugus county, N. Y.

MYTILARCA CARINATA.

PLATE XXXII, FIGS. 15-19; AND PLATE XXXIII, FIG. 8.

Mytilarca carinata, HALL. MSS. 1877.
" " " S. A. MILLER, in Cat. Amer. Pal. Foss., p. 197. 1877.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, figs. 15–19. Jan., 1883.

SHELL of small or medium size; body obliquely sub-ovate; length nearly twice the height, except in young specimens; ventral margin nearly straight or slightly concave for more than three-quarters of the length of the shell, thence rounding abruptly into the basal margin, then more gently rounded into the gently curving dorsal margin.

Valves equal, depressed-convex in the posterior part, becoming moderately convex in the middle and scarcely gibbous above. The ventral umbonal slope is angular, and the shell between it and the margin is concave.

Hinge-line short, less than the height of the shell. Beaks anterior, prominent, acute, slightly curving forward.

Test thin, marked by very fine concentric striæ of growth, which are crowded on the anterior side and toward the base.

Ligamental area of moderate width, finely striated longitudinally. Cardinal teeth small, diverging, situated under the extremity of the beak. Lateral teeth two, small, oblique, situated just below the posterior extremity of the hinge-line. Other characters of the interior unknown.

A specimen has a length of 30 mm. and height 18 mm. A more elongate form has a length of 43 mm. and height 20 mm. A small individual has a length of 23 mm. and height 15 mm.

This form differs from *M. Chemungensis* in its proportionally shorter form, the young shells have a sub-triangular aspect, the ventral umbonal slope is always angular, and the body is more distinctly arcuate.

Formation and localities. In the middle portion of the Chemung group, Tioga and Chemung counties, N. Y.

MYTILARCA REGULARIS, n. sp.

PLATE XXXII, FIG. 12.

SHELL above the medium size; body narrowly ovate; length less than twice the height; byssal area scarcely depressed; ventral margin for two-thirds the length nearly straight, thence curving into the posterior margin which is regularly rounded; dorsal margin gently curving to the extremity of the cardinal line.

Left valve gently and regularly convex in the posterior half, convex above and scarcely gibbous on the umbo. Right valve unknown.

Hinge-line straight, short, oblique. Beak nearly erect, acute and abruptly attenuate.

Test thin, marked by fine elevated concentric striæ which are crowded on the ventral and dorsal sides of the valve.

Ligamental area narrow, longitudinally striated.

Interior unknown.

The specimen described has a length of 48 mm. and height 28 mm.

As compared with *M. Chemungensis* this species has a proportionally wider form; it is more nearly equilateral, the umbonal elevation is less abrupt and more nearly central. It is proportionally higher than *M. occidentalis* and less elevated along the umbonal slope.

Formation and locality. In a sandstone of the Chemung group, near Leon Centre, Cattaraugus county, N. Y.

MYTILARCA ATTENUATA.

PLATE XXXII, FIG. 20.

Mytilarca attenuata, HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 23. 1869.
" " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 32, fig. 20. Jan., 1883.

SHELL above medium size; body extremely elongate, sub-cuneiform; length nearly three times the height; ventral margin nearly straight for almost the entire length, with a slight depression at the byssal opening; posterior margin abruptly rounded, gently curving into the dorsal margin which is straight above the middle.

Right valve gently convex in the posterior part, becoming gibbous and angular in the umbonal region. Left valve unknown.

Beak erect, acute, pointed.

Test of moderate thickness, marked by fine concentric striæ of growth, which at intervals have been raised into lamellæ which have left strong varices upon the cast.

Interior unknown.

A right valve has a length of 65 mm. and height 24.5 mm.

This species differs from *M. Chemungensis* in its more elongate, straighter form, and in the angularity of the umbonal slope. From *M. carinata* it is distinguished by its elongate form, straight ventral side, and more prominent anterior umbonal slope.

Formation and locality. In the arenaceous beds associated with fossils of the middle Chemung group, from a loose mass collected at Elmira, N. Y.

MYTILARCA SIMPLEX.

PLATE XXXIII, FIGS. 19, 21.

Mytilops (*Modiola*) *simplex*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, figs. 19, 21 (20 in error) Jan., 1883.

SHELL of medium size; body elongate-ovate, with an acute apex; length nearly twice the height; byssal area depressed; margin below nearly straight for two-thirds the length; posterior margin abruptly rounded; dorsal margin gently curving to the hinge-line.

Valves equal, moderately convex in the posterior part, and gibbous on the umbo. The line of greatest convexity is on the ventral side of the axis.

Hinge-line short. Beaks sub-erect, acute, abruptly attenuate.

Test marked by fine, closely arranged, concentric striæ.

Ligamental area and interior unknown.

A specimen has a length of 41 mm. and height 25 mm.

This species is somewhat intermediate to *M. Chemungensis* and *M. regularis*, but is distinguished from the former by its shorter form, and from the latter by its greater convexity and more attenuate beak. This form and the succeeding, were referred to Mytilops, but a careful comparison shows them to be related to the species here arranged under Mytilarca.

Formation and locality. In the sandstones of the Chemung group, west of Smethport, Pa.

Mytilarca gibbosa, n. sp.

PLATE XXXIII, FIG. 20; AND PLATE LXXXVII, FIG. 7.

Shell of medium size; body ovate-arcuate, obliquely truncate along the hinge-line; length less than twice the height; ventral margin nearly straight for more than three-fourths the length, abruptly curving into the posterior margin, thence gently rounded to the extremity of the hinge-line.

Left valve very convex; the greatest convexity above the middle. Umbonal region gibbous. Right valve unknown.

Hinge-line oblique, nearly equal to the height of the shell. Beak small, appressed, arching toward the ventral side.

Test marked by fine concentric striæ, which, at irregular intervals, are crowded into fascicles, leaving varices upon the surface of the cast.

Interior unknown.

The specimen described has a length of 45 mm., and height 26 mm.

This species is proportionally longer, beak more acute, and much more gibbous than *M. lata*.

Formation and locality. In the Upper Chemung group, Napoli, Cattaraugus county, N. Y.

Mytilarca lata.

PLATE XXXIII, FIG. 22.

Mytilops (Modiola) lata, Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, fig. 22 Jan., 1883.

Shell large; body broadly sub-elliptical, abruptly narrowing toward the beak on the dorsal side; length one-third greater than the height; byssal area slightly inflated, thence nearly straight for almost three-fourths the length of the shell; posterior margin broadly rounded; dorsal margin gently curved for two-thirds of the length and then truncated in nearly a direct line to the beak.

Right valve moderately convex in the posterior part, becoming broadly convex in the middle, and somewhat gibbous in the umbonal region. Left valve unknown.

Hinge-line oblique; extent unknown. Beak elevated, erect, acute.

Test marked by rather coarse, elevated lines of growth.

Interior unknown.

The specimen described has a length of 60 mm. and height 40 mm.

This species somewhat resembles *M. regularis* but the beak is more anterior, the body wider and more convex, and the truncation of the cardinal margin is much longer.

Formation and locality. In the Chemung group, Randolph, Cattaraugus county, N. Y.

MYTILARCA OCCIDENTALIS.

PLATE XXXIII, FIGS. 3-5; AND PLATE LXXXVII, FIG. 11.

Mytilus occidentalis, WHITE and WHITFIELD. Proc. Boston Soc. Nat. Hist., vol. viii, p. 297. 1862.
Mytilarca occidentalis (W. and W.), HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 24. 1869.
" " " " Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, figs. 3–5. Jan., 1883.

SHELL above the medium size; body extremely elongate, narrow-ovate; length more than twice the height; ventral margin a little inflated at the byssal opening, then gently curving to the posterior margin which is abruptly rounded, and broadly curving along the dorsal side.

Valves equal, convex in the posterior part, becoming gibbous below the middle and anteriorly; the greatest convexity is anterior to the middle.

Hinge-line short. Beaks acute, nearly erect. The umbonal region is narrow and the convexity is continued along the median line to the posterior end of the shell.

Test thin, marked by numerous fine concentric striæ, which at irregular intervals have been raised into imbricating lamellæ, leaving strong varices on the cast.

Interior unknown.

A specimen has a length of 52 mm. and height 25 mm.

This species is distinguished from *M. Chemungensis* by its straighter form, erect beaks, and convexity along the medial line.

Formation and locality. In the Yellow sandstones, at Burlington, Iowa.

MYTILARCA FIBRISTRIATA.

PLATE XXXIII, FIGS. 6, 7; AND PLATE LXXXVII, FIG. 6.

Mytilus fibristriatus, WHITE and WHITFIELD. Proc. Boston Soc. Nat. Hist., vol. viii, p. 296. Feb., 1862.
" *Whitfieldianus*, WINCHELL. Proc. Acad. Nat. Sci., Phila., p. 413. Sept., 1862.
" " " " " p. 11. 1863.
Mytilarca fibristriata, (W. and W.), HALL. Prelim. Notice, Lam. Shells, etc., pt. 2, p. 24. 1869.
" *fibristriata* (W. and W.) (*fimbristriata, in error*), HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, figs. 6, 7. Jan., 1883.

SHELL of medium size; body very elongate, narrow elliptical; length more than twice the height; byssal area convex and inflated; ventral margin nearly straight for two-thirds the length, thence curving into the abruptly rounded posterior extremity; dorsal margin very gently curved to the extremity of the hinge-line.

Valves equal, moderately convex in the posterior part, becoming gibbous in the middle and anterior.

Hinge-line short, oblique. Beaks narrow, sub-erect. Umbonal region narrowly gibbous.

Test thin, marked by fine, thread-like, undulating radii, which are more or less interrupted by the fine concentric striæ.

Interior unknown.

A specimen has a length of 48 mm., and height 22 mm.

This species is distinguished from *M. occidentalis* by its lesser gibbosity; the convexity of the body is along the ventral side instead of the median line; and by the presence of undulating, filamentous radii.

Formation and locality. In the Yellow sandstones at Burlington, Iowa.

GOSSELETTIA, Barrois.

Gosselettia triquetra.

PLATE XXXI, FIGS. 9-17; AND PLATE LXXXVII, FIG. 12.

Pterinea triqueter, Conrad. Geolog. Surv. N. Y.: Ann. Rept., p. 116. 1838.
Mytilarca triqueter (Conrad), Hall. Prelim. Notice Lam. Shells, etc., p. 22. 1869.
Gosselettia triquetra (Conrad), Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 31, figs. 9–17. Jan., 1883.

Shell of medium to large size; body triangular, oblique; in young shells the height and length are nearly equal, in older shells becoming more elongate; anterior margin truncate, flattened on the ventral side; posterior margin broadly rounded.

Valves equal, very convex, sub-angularly gibbous along the ventral side. The convexity or breadth of the closed valves is about equal to the height of the shell. Ventral side vertical. Dorsal side sloping very abruptly in young individuals, and less abruptly in older shells.

Hinge-line straight, nearly or quite equalling the height of the shell. Beaks anterior, strong, elevated and incurved.

Test thick, marked by fine concentric lines of growth which are crowded and much elevated on the anterior side. In older specimens the striæ become irregular and lamellose toward the basal margin.

Ligamental area comparatively wide and very finely striated longitudinally. Cardinal teeth three, strong and somewhat diverging. Lateral teeth elongate and extending nearly to the posterior extremity of the hinge-line. The anterior muscular scar is sub-circular, deep, situated near the inner border of the cardinal plate and truncating the anterior cardinal tooth.

A medium-sized specimen has a length of 58 mm., height 43 mm., breadth 41 mm. A larger individual has a length of 80 mm. and height 55 mm.

The older shells present some similarity to *M.* (*Plethomytilus*) *oviformis*, but the ventral angular slope is characteristic. In young specimens the triangular and extremely gibbous form distinguish it from all other species here described.

It is referred to the genus GOSSELETTIA of Barrois, from the Devonian of Spain, on account of its similarity of external form and the strong cardinal teeth; otherwise it has all the characters of MYTILARCA.

Formation and localities. In the shales of the Hamilton group, Fultonham, Schoharie county, and Onondaga county, N. Y.

GOSSELETTIA RETUSA.

PLATE XXXIII, FIGS. 1, 2.

Gosselettia retusa, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 30, figs. 1, 2. Jan., 1883.

SHELL of medium size; body very oblique, rhomboid-ovate, sub-arcuate; length one-third greater than the height; ventral margin nearly straight for two-thirds of the length, inflated at the byssal opening and concave below, thence abruptly curving into the broad basal and dorsal margin.

Valves equal, regularly convex in the posterior part and gibbous in the umbonal region; the point of greatest convexity is above the middle. The ventral umbonal slope is sub-angular. Ventral side flat.

Hinge-line short. Beaks acute, prominent, directed a little forward and incurved.

Test of moderate thickness, marked by lamellose concentric lines of growth which at irregular distances are crowded into fascicles.

Ligamental area and interior unknown.

The specimen described has a length of 49 mm., height 32 mm., breadth 30 mm.

This species differs from *G. triquetra* in its proportionally longer form, which is less expanded posteriorly; hinge-line shorter and less oblique to the body of the shell; and the ventral umbonal slope is less angular along the length.

Formation and locality. In the Hamilton group, Eighteen mile creek, Erie county, N. Y.

MODIOLA, Lamarck,

Sub-Genus MYTILOPS, Hall.

Modiola (Mytilops) præcedens.

PLATE XXXIII, FIGS. 9-18.

Modiola præcedens, Hall. Prelim. Notice of the Lam. Shells, etc., pt. 2, p. 1. 1869.
Mytilops (*Modiola*) *præcedens,* Hall. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, figs. 9-18. Jan., 1883.

Shell of medium size; body elongate, semi-elleptical, broadly and obtusely sub-triangular; length a little more than twice the height; byssal margin slightly sinuate; anterior end compressed, abruptly rounded, nearly straight or gently curving along the ventral side, acutely recurved at the posterior extremity, thence broadly rounded to the extremity of the hinge.

Valves equal, convex below, becoming gibbous and angular anteriorly. The line of greatest convexity extends from the beak to the post-ventral extremity, slightly arcuate.

Hinge-line slightly arcuate, sub-alate; length nearly half the length of the valve. Beaks small, sub-terminal, slightly incurved.

Test marked by fine, equal, concentric striæ, and by fine, wrinkled radii, which diverge along the median line and curve toward the opposite margins.

Ligamental area with one or two longitudinal grooves.

Interior unknown.

A small specimen has a length of 28 mm., and height 12 mm. A medium-sized specimen has a length of 36 mm., and height 17 mm.

Formation and localities. In a conglomerate of the Chemung group, Portville, Alleghany county, N. Y., and south-east of Smethport, Pa.

MODIOLA (MYTILOPS) METELLA.

PLATE XXXIII, FIGS. 23, 24; AND PLATE LXXXVII, FIG. 9.

Modiola metella, HALL. Prelim. Notice Lam. Shells, etc., pt. 2, p. 1. 1869.
Mytilops (*Modiola*) *metella*, HALL. Pal. N. Y., vol. v, pt. 1. Plates and Explanations: Pl. 33, figs. 23, 24. Jan., 1883.

SHELL large; body narrow elliptical, sub-arcuate, obliquely truncate on the anterior dorsal side; length more than twice the height; ventral margin gently curving, nearly straight for three-fourths of the length, thence abruptly rounded at the posterior extremity; dorsal margin very gently curving to the extremity of the hinge-line.

Valves equal, depressed-convex at the posterior end, becoming gradually more convex to a point anterior to the middle of the length, and gibbous in the umbonal region.

Hinge-line oblique, about equal to the height of the valve. Beaks small, appressed.

Test thin, marked by concentric striæ.

Ligamental area marked by two slender grooves. Other interior characters unknown.

A specimen has a length of 57 mm., height 25 mm., and hinge-line 24 mm.

This species differs from *M. præcedens* in its larger form, which is less expanded posteriorly, less angular and gibbous along the umbonal slope, and without radii on the surface so far as can be determined in the specimens.

Formation and localities. In a conglomerate of the Chemung group, at Panama, and in a boulder of similar rock on the road from Ellington to Cherry creek, Chautauqua county, N. Y., and at Warren, Pa.

PLATES AND EXPLANATIONS.

PLATE I.

AVICULOPECTEN CLEON.

Page 6.

Fig. 1. The left valve of the specimen described. The specimen is not so nearly entire as represented in the figure.

Upper Helderberg group. *Columbus, Ohio.*

AVICULOPECTEN IGNOTUS.

Page 33.

Fig. 2. A left valve, from which the shell has been almost entirely exfoliated.

Upper Helderberg group. *Near Victor, Ontario Co., N. Y.*

AVICULOPECTEN (PTERINOPECTEN?) TERMINALIS.

Page 32.

Fig. 3. A left valve enlarged to two diameters.

Upper Helderberg group. *Williamsville, Erie Co., N. Y.*

PTERINOPECTEN INSONS.

Page 59.

Fig. 4. The exfoliated left valve described, enlarged to two diameters.

Upper Helderberg group. *Western N. Y.*

LYRIOPECTEN DARDANUS.

Page 41.

Fig. 5 A view of an imperfect left valve, taken from a gutta-percha impression of the natural mould. The specimen is more extended on the anterior side than is represented in the figure, and there is an intermediate set of finer rays, also, not shown.

Upper Helderberg group. *Le Roy, N. Y.*

PTERINOPECTEN MULTIRADIATUS.

Page 57.

Fig. 6. The left valve described.

Fig. 7. A view of the impression left in the matrix.

Upper Helderberg group. *Stafford, Genesee Co., N. Y.*

AVICULOPECTEN INSIGNIS.

Page 34.

See Plates 3 and 81.

Fig. 8. An imperfect left valve, enlarged to two diameters.

Hamilton group. *Stafford, Genesee Co., N. Y.*

AVICULOPECTEN PECTENIFORMIS.

Page 4.

Fig. 9. The original specimen described.

Upper Helderberg group. *Schoharie, N. Y.*

UPPER HELDERBERG & HAMILTON GROUPS.

(PECTINIDÆ.)

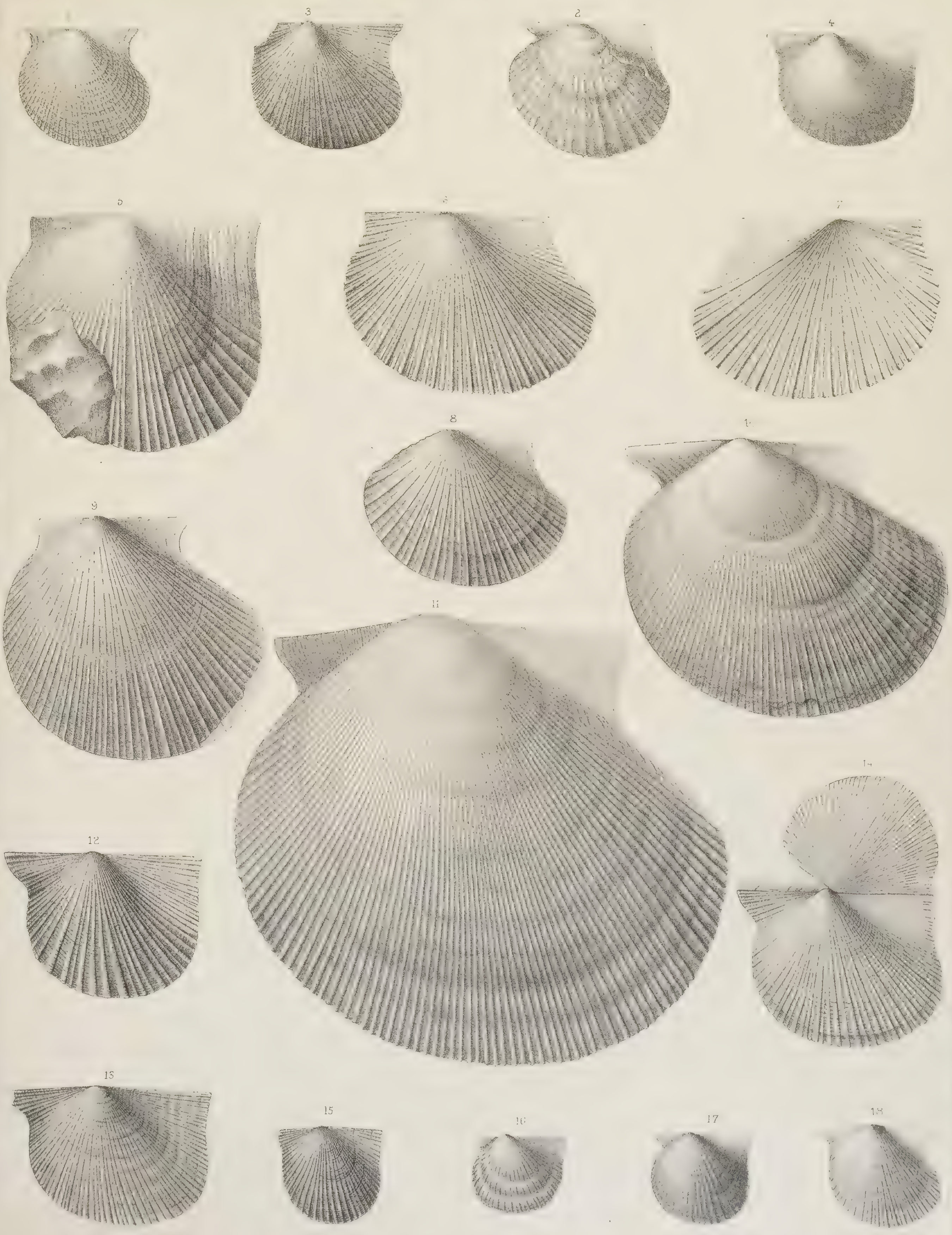


PLATE I—Continued.

AVICULOPECTEN PRINCEPS.

Page 1.

See Plates 5, 6, 24 and 81.

Fig. 10. A left valve.

Upper Helderberg group. *Falls of the Ohio.*

Fig. 11. A larger left valve of this species. The hinge-line should be represented as straight.

Upper Helderberg group. *Beargrass creek, Ky.*

PTERINOPECTEN DIGNATUS.

Page 62.

Fig. 12. A left valve, enlarged to two diameters, showing the form and surface characters.

Fig. 14. A specimen retaining both valves, enlarged to two diameters, showing their comparative form and surface ornamentation. The anterior ear of the right valve has much stronger rays than represented.

Fig. 15. An imperfect left valve, natural size.

Marcellus shale. *Bloomfield, Ontario Co., N. Y.*

PTERINOPECTEN LÆTUS.

Page 63.

Fig. 13. The left valve of the specimen described, × 2. The umbo should be represented as free from radii, and concentrically wrinkled.

Marcellus shale. *Bloomfield, Ontario Co., N. Y.*

PTERINOPECTEN EXFOLIATUS.

Page 61.

See Plate 83.

Fig. 16. A medium sized left valve of this species.

Limestone of the Marcellus shale. *Avon, N. Y.*

Fig. 17. A large left valve, with the test more exfoliated than the preceding.

Limestone of the Marcellus shale. *Vienna, Ontario Co., N. Y.*

AVICULOPECTEN (PTERINOPECTEN ?) INVALIDUS.

Page 31.

See Plate 82.

Fig. 18. A left valve, × 2. Fig. 21, plate 82, gives a more entire outline of this species and of the natural size.

Marcellus shale. *Cherry Valley, N. Y.*

PLATE II.

LYRIOPECTEN INTERRADIATUS.

Page 44.

See Plate 82.

Fig. 1. A small left valve.
Fig. 2. A specimen of medium size.
Fig. 3. The right valve belonging to the left valve, fig. 1.
Fig. 4. The right valve of fig. 2.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

AVICULOPECTEN BELLUS.

Page 35.

See Plate 81.

Fig. 5. A small left valve, × 2.
Fig. 6. A similar left valve, × 2.
Fig. 9. A specimen preserving both valves, showing their comparative form and relations, × 2.
Hamilton group. *Near Bellona, N. Y.*

AVICULOPECTEN ORNATUS.

Page 37.

See Plate 3.

Fig. 7. A small specimen preserving both valves slightly displaced, and the right one imperfect; showing the form and ornamentation, × 2.
Fig. 8. A larger specimen, similar to the preceding, but with the surface characters partially obliterated from maceration, × 2.
Hamilton group. *Canandaigua lake, N. Y.*

PTERINOPECTEN UNDOSUS.

Page 72.

See Plate 82.

Fig. 10. A small left valve, showing the great proportional length of hinge-line in the young shell.
Hamilton group. *Canandaigua lake, N. Y.*
Fig. 11. A large left valve, having very distant equal radii.
Hamilton group. *Bethany, N. Y.*
Fig. 12. A right valve, showing numerous concentric undulations.
Hamilton group. *Canandaigua lake, N. Y.*
Fig. 13. A right valve preserving two strong undulations in the umbonal region, more subdued concentric lines below, and numerous fine radii.
Corniferous limestone. *Clarence Hollow, N. Y.*
Fig. 14. A right valve preserving a portion of the test on the upper anterior side and anterior ear.
Hamilton group. *Canandaigua lake, N. Y.*
Fig. 15. A characteristic right valve.
Fig. 16. A large right valve, showing numerous concentric undulations.
Hamilton group. *Canandaigua lake, N. Y.*
Fig. 17. A small specimen preserving both valves and showing strong undulations.
Hamilton group. *Canandaigua lake, N. Y.*
Figs. 18, 19. Two nearly entire large left valves.
Hamilton group. *Geneseo, Livingston Co., N. Y.*

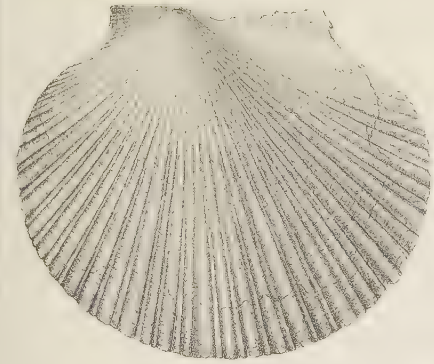
HAMILTON GROUP.

(PECTINIDÆ.)

Palæontology N.Y. Vol.V.

Plate II.

2



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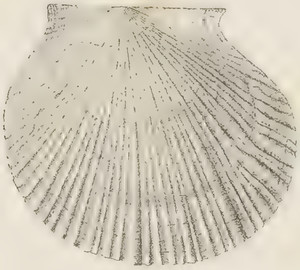

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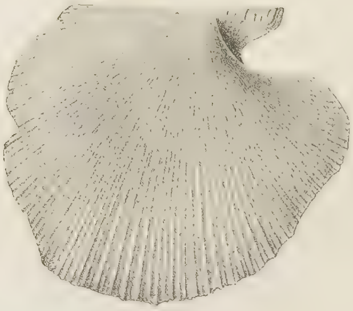

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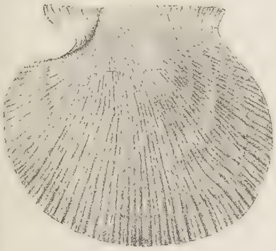

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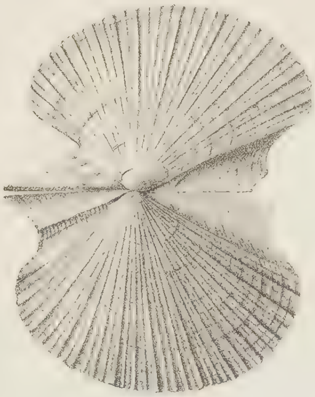

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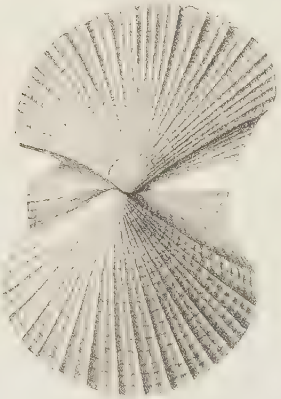

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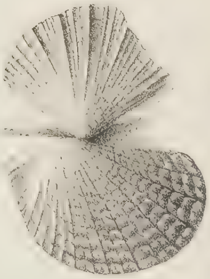

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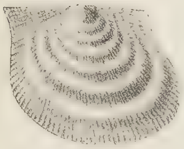

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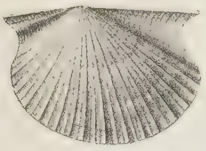

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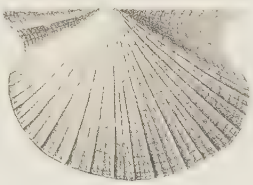

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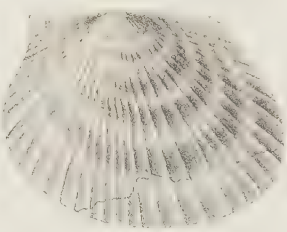

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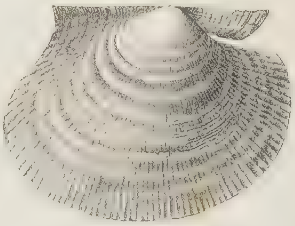

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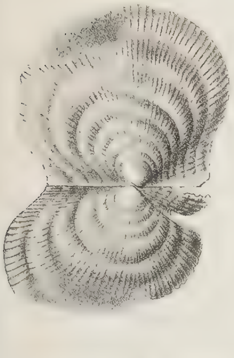

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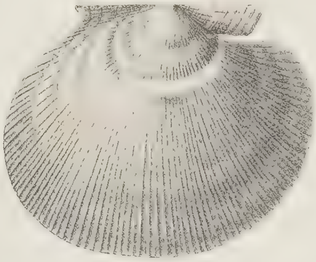

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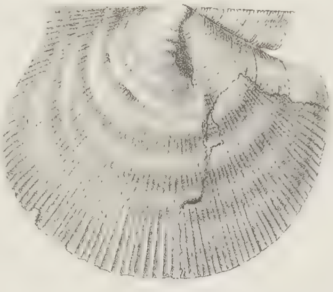

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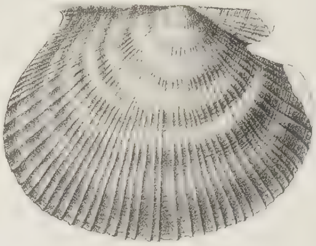

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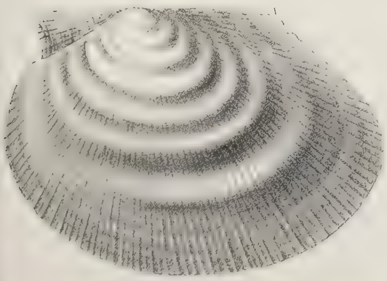

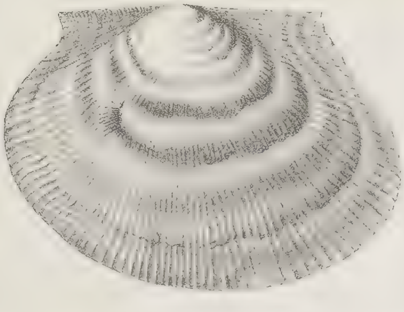

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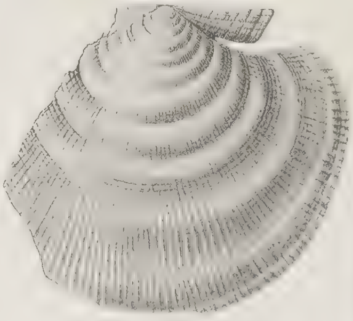

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PLATE III.

AVICULOPECTEN IDAS.

Page 13.

See Plate 24.

Fig. 1. A small right valve.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 2. A larger example of more nearly normal proportions.
Hamilton group. *Darien, N. Y.*

AVICULOPECTEN SCABRIDUS.

Page 7.

Fig. 3. A young individual, apparently, of this species, slightly narrowed by compression.
Hamilton group. *Bellona, N. Y.*

Fig. 4. A left valve with the surface much distorted, but preserving a very perfect outline.
Hamilton group. *Canandaigua lake, N. Y.*

Fig. 5. The cardinal portion of a right valve.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 6. A left valve of medium size; imperfect at the cardinal extremities.
Hamilton group. *Delphi Falls, N. Y.*

Fig. 7. An imperfect right valve preserving the surface characters of the ears, as obtained from the matrix after the removal of the specimen.

Fig. 8. An enlargement from the surface of a specimen preserving the test.
Hamilton group. *Geneseo, Livingston Co., N. Y.*

Fig. 9. An enlargement of the surface of specimen, fig. 7, taken from the middle of the valve.

Fig. 10. A large left valve preserving a very perfect outline, with a portion of the test adhering to the lower anterior portion.
Hamilton group. *Bellona, N. Y.*

Fig. 11. An enlargement of a portion of the test of the preceding specimen.

Fig. 12. An enlargement from the surface of a specimen denuded of the test.
Hamilton group. *Crooked lake outlet, N. Y.*

AVICULOPECTEN INSIGNIS.

Page 34.

See Plates 1 and 81.

Fig. 13. The interior of a right valve imbedded in shale, showing the ornamentation as it appears on the interior of the shell.
Hamilton group. *Hamburg, Erie Co., N. Y.*

AVICULOPECTEN ORNATUS.

Page 37.

See Plate 2.

Fig. 14. The interior of a left valve imbedded in shale, × 2.
Hamilton group. *Canandaigua lake, N. Y.*

AVICULOPECTEN MUCRONATUS.

Page 38.

Fig. 15. The interior of a left valve imbedded in shale.
Hamilton group. *Dresden, Yates Co., N. Y.*

AVICULOPECTEN LAUTUS.

Page 14.

See Plate 81.

Fig. 16. The interior of two attached valves imbedded in shale, showing their comparative form and proportions.
Hamilton group. *West Bloomfield, N. Y.*

Fig. 17. The interior of a left valve preserved as the preceding. Another figure of this specimen is given on plate 81, fig. 5, taken from an impression of this mould.
Hamilton group. *York Centre, Livingston Co., N. Y.*

AVICULOPECTEN EXACUTUS.

Page 8.

Fig. 18. The interior of a left valve imbedded in shale.
Hamilton group. *Hamburg, Erie Co., N. Y.*

Fig. 19. A small left valve with the anterior ear imperfect.
Hamilton group. *Canandaigua lake, N. Y.*

Fig. 20. A large imperfect left valve. The beak is represented as too acute, and the concentric lamellæ are not shown as on the specimen.
Hamilton group. *Hamburg, Erie Co., N. Y.*

Fig. 21. A left valve denuded of the test. The specimen shows the pallial line and muscular impression, as described in the text.

Fig. 22. The upper portion of a right valve preserving the test.
Hamilton group. *Hamburg, Erie Co., N. Y.*

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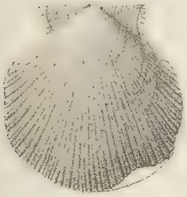

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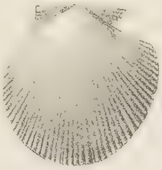

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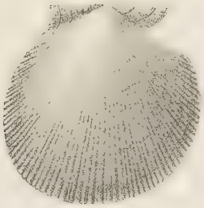

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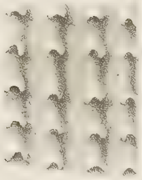

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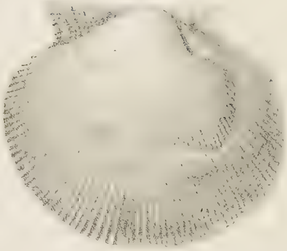

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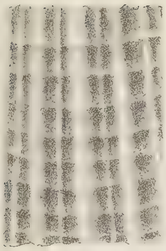

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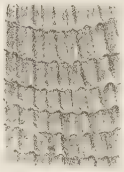

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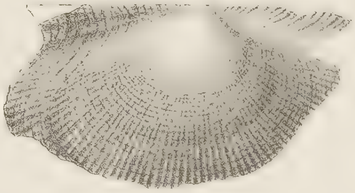

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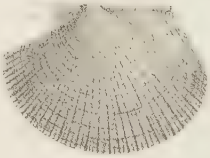

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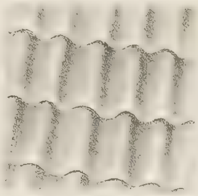

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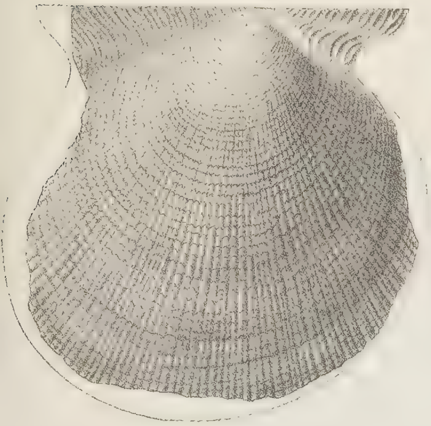

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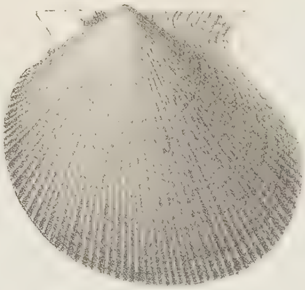

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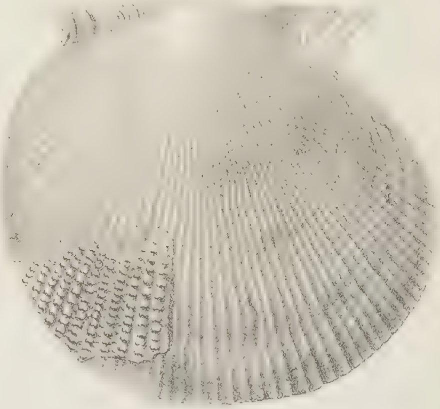

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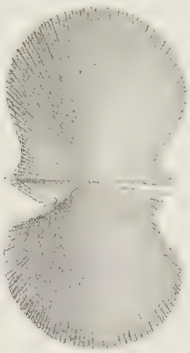

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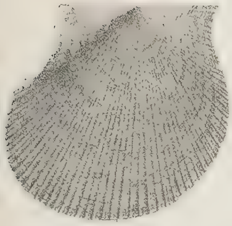

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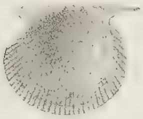

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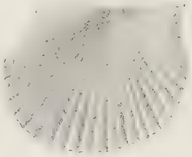

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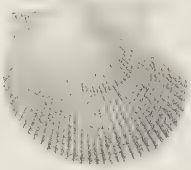

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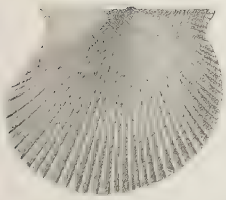

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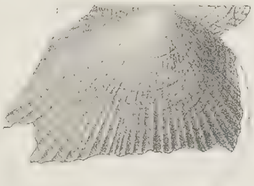

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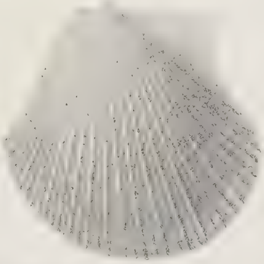

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PLATE IV.

LYRIOPECTEN PARALLELODONTUS.

Page 40.

Fig. 1. The exterior of an imperfect right valve, as obtained from an impression of the exterior of the shell in the matrix. The sinus in the margin of the posterior ear is represented as too deep.

Fig. 2. The interior mould of the preceding valve, showing the ligamental grooves. The specimen also preserves traces of the pallial line and muscular impression.

Schoharie grit. *Albany Co., N. Y.*

LYRIOPECTEN ORBICULATUS.

Page 42.

See Plate 82.

Fig. 3. The interior of a small left valve imbedded in shale, showing a very perfect outline.

Hamilton group. *Geneseo, Livingston Co., N. Y.*

Fig. 4. The exterior of an exfoliated left valve. This specimen is the original of fig. 1, p. 202, Geolog. Rept. Fourth Dist. N. Y.

Encrinal limestone of the Hamilton group. *Shore of Lake Erie, N. Y.*

Fig. 5. A left valve preserving a portion of the cardinal area. The ligamental area in the specimen shows several longitudinal grooves much stronger than represented; the figure is also too narrow and the anterior ear too obtuse.

Hamilton group. *Baileytown, N. Y.*

Fig. 6. A large left valve, showing the obliquity of the body consequent to age, and the comparatively short hinge-line, although the latter is represented as too short in the figure.

Hamilton group. *Moscow, N. Y.*

Fig. 7. A portion of the ligamental area of the right valve of specimen × 3, showing the longitudinal grooves, with a slight bending outward under the beak.

Hamilton group. *York Centre, Livingston Co., N. Y.*

Fig. 8. A large left valve preserving some portions of the test, and otherwise quite imperfect from maceration and exfoliation.

Hamilton group. *Canandaigua lake, N. Y.*

LYRIOPECTEN MACRODONTUS.

Page 46.

See Plate 8.

Fig. 9. A large imperfect mould of the interior, showing the coarse grooves of the ligamental area. The muscular impression is preserved in the specimen, but is not represented in the figure.

Hamilton group. *Worcester, Otsego Co., N. Y.*

LYRIOPECTEN ANOMIÆFORMIS.

Page 53.

See Plates 10 and 82.

Fig. 10. An imperfect right valve, showing a portion of the hinge area and the deep byssal sinus. The rays, as represented, are too strong; they should be fine, undulating and unequal in size.

Chemung group. *Chemung river, Upper Narrows, N. Y.*

LYRIOPECTEN TRICOSTATUS.

Page 48.

See Plates 7 and 10.

Fig. 11. An imperfect left valve. By a fault in the lithography, the secondary and tertiary rays are represented too nearly alike, instead of alternating in size and strength.

Hamilton group. *Near Summit, Schoharie Co., N. Y.*

UPPER HELDERBERG & HAMILTON GROUPS.

(PECTINIDÆ)

Plate IV.

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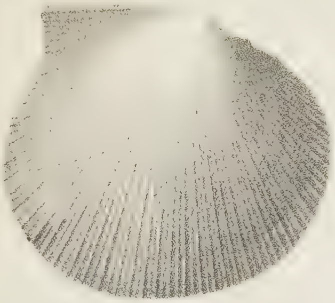

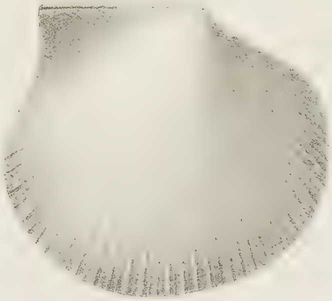

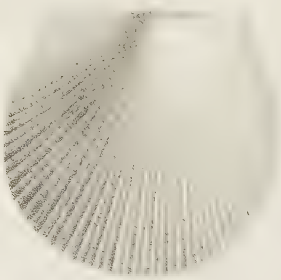

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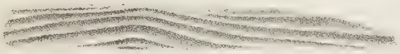

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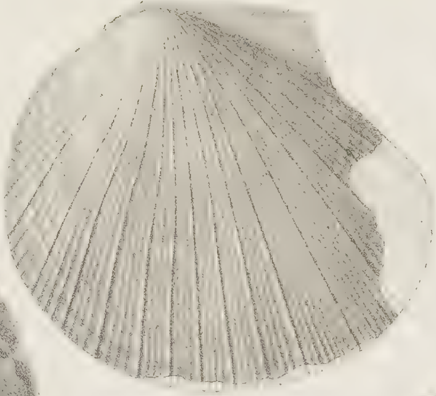

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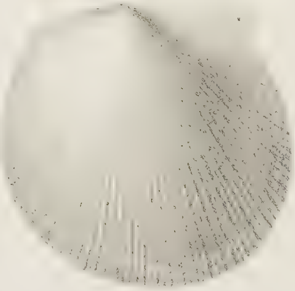

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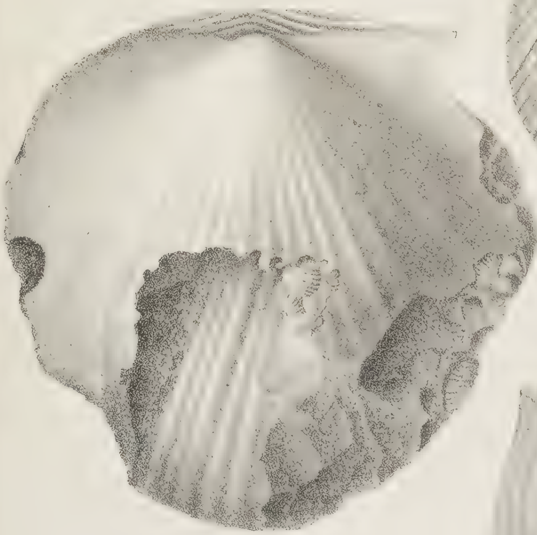

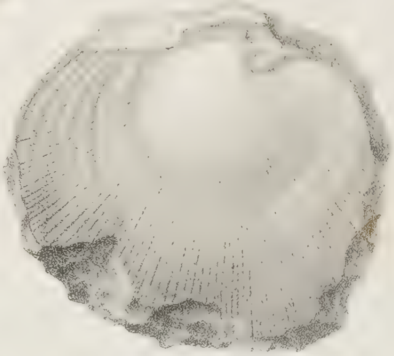

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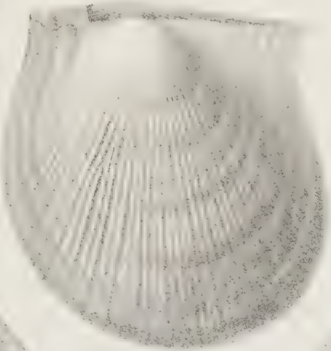

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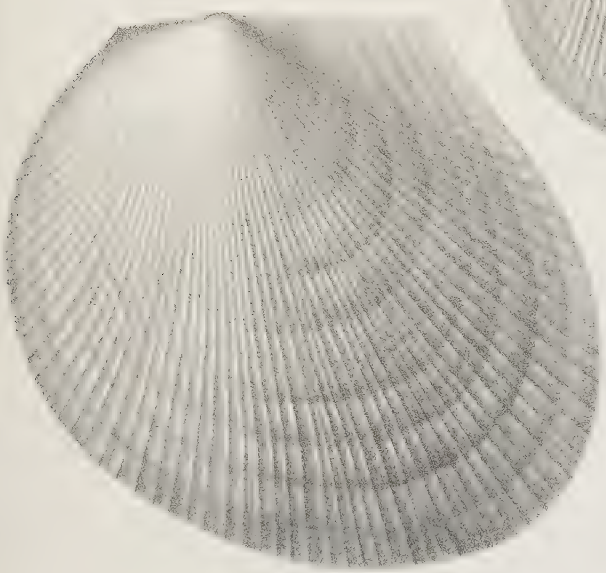

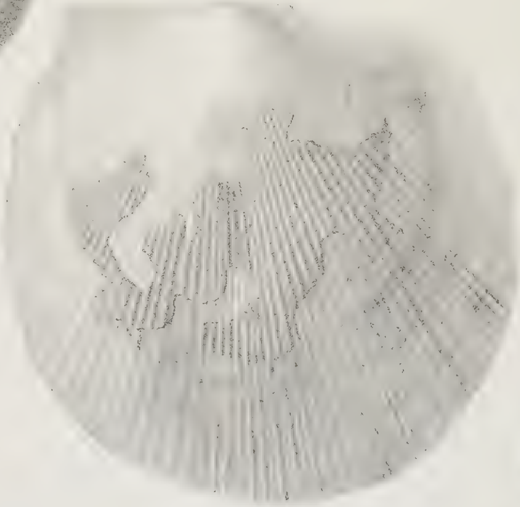

PLATE V.

PTERINOPECTEN VERTUMNUS.

Page 71.

See Plate 83.

Figs. 1-6. Left valves of various sizes, showing slight variations in outline, and considerable variation in the number and strength of the rays.

Fig. 7. A small right valve. The byssal sinus is not represented sufficiently deep.

Fig. 8. A specimen preserving both valves, showing their comparative form and surface ornamentation.

Hamilton group. *Schoharie Co., N. Y.*

AVICULOPECTEN FASCICULATUS.

Page 11.

See Plate 81.

Figs. 9, 10. Two small left valves.

Hamilton group. *Fultonham, Schoharie Co , N. Y.*

Fig. 11. A left valve. Another figure of this specimen is given on plate 81, fig. 3, showing the concentric striæ.

Hamilton group. *Castleton, Ontario Co., N. Y.*

Fig. 12. A left valve which is much produced posteriorly. The specimen is imperfect at the beak, and is restored in the figure.

Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 13. An imperfect left valve, showing strong fascicles of radiating striæ.

Figs. 14, 15. Two large left valves, with simple thread-like striæ ornamenting the surface.

Fig. 16. A small right valve of this species.

Hamilton group. *Schoharie Co., N. Y.*

Fig. 17. A left valve presenting great irregularities in the radii, due to accident and intermittent growth.

Hamilton group. *Cazenovia, N. Y.*

AVICULOPECTEN PRINCEPS.

Page 1.

See Plates 1, 6, 24 and 81.

Fig. 18. A small left valve preserving a portion of the test.

Hamilton group. *Canandaigua lake, N. Y.*

Fig. 19. A portion of the test enlarged, showing the surface ornamentation.

Fig. 23. An imperfect left valve.

Hamilton group. *Western N. Y.*

Fig. 24. An entire and characteristic right valve.

Hamilton group. *Cazenovia, N. Y.*

AVICULOPECTEN FORMIO.

Page 9.

Fig. 20. An imperfect left valve of the species. The margins of both ears are represented as too concave in the figure.

Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 21. A smaller specimen retaining both valves.

Hamilton group. *Madison Co., N. Y.*

AVICULOPECTEN PHORCUS.

Page 10.

Fig. 22. A left valve preserving a nearly entire outline.

Hamilton group. *Schoharie Co., N. Y.*

HAMILTON GROUP.

(PECTINIDÆ)

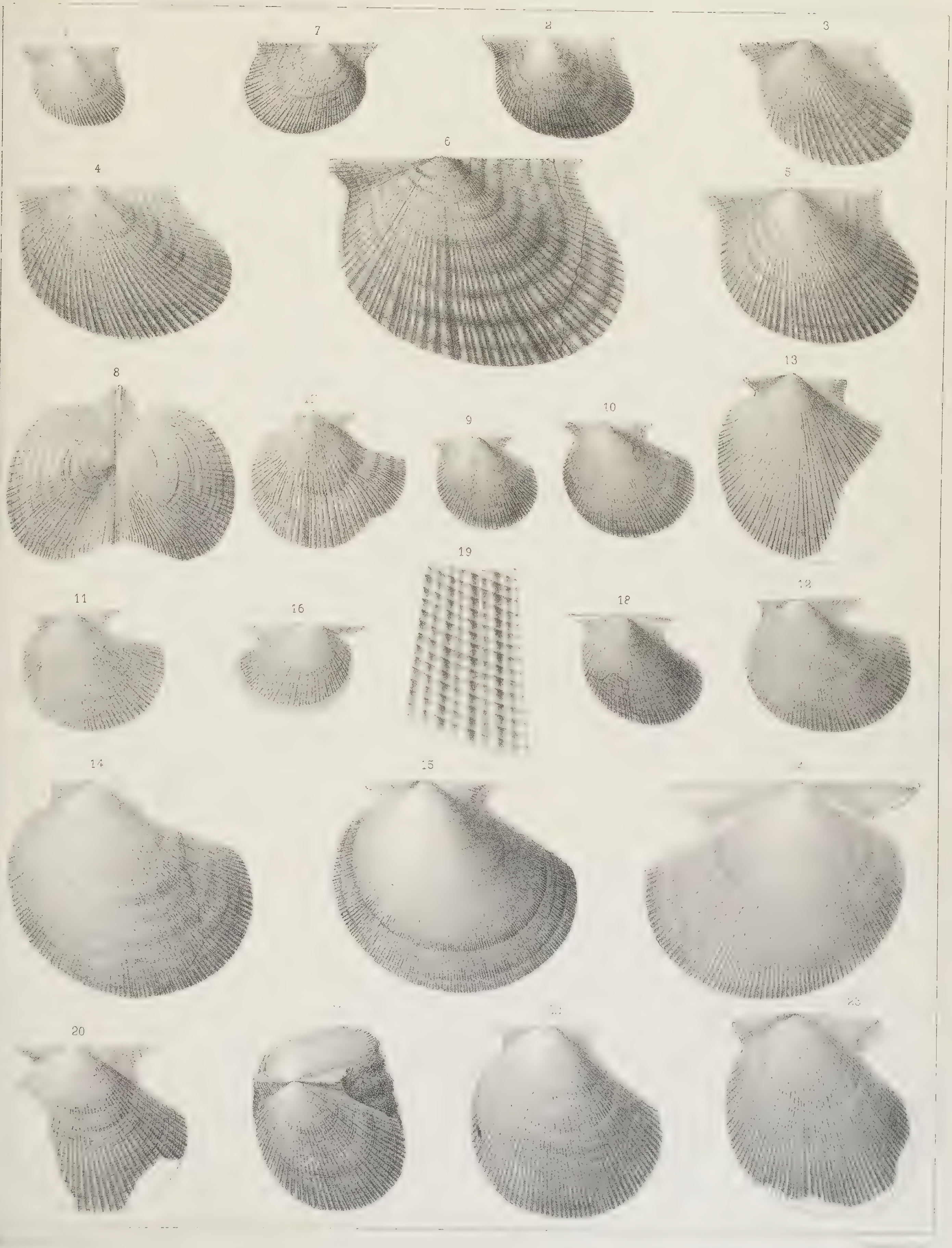

PLATE VI.

AVICULOPECTEN PRINCEPS.

Page 1.

See Plates 1, 5, 24 and 81.

Fig. 1. A large left valve, much extended posteriorly.
Hamilton group. *Seneca lake, N. Y.*

Fig. 2. The impression of the exterior of a large right valve, showing the ligamental area. The spot near the middle of the valve has been caused by the attachment of a *Crania* to the exterior of the shell. Hamilton group. *Hamilton, N. Y.*

Fig. 3. An impression of the interior of a right valve. The striated ligamental area is shown in the specimen, but not represented in the figure.
Hamilton group. *Hamilton, Madison Co., N. Y.*

Fig. 4. An imperfect left valve.

Fig. 5. The right valve attached to the preceding, showing the comparative size and ornamentation.

Fig. 6. A small oblique left valve. The hinge-line should be represented as straight, and with a strong ligamental area.

Fig. 7. A specimen preserving both valves.
Hamilton group. *Borodino, N. Y.*

Fig. 8. A left valve, showing the ordinary characters of the species. The ligamental area is preserved in the specimen, but not here represented, and the hinge-line is too short in the figure. This valve is associated with, and probably belonged to the right valve shown in figure 3.
Hamilton group. *Hamilton, N. Y.*

Fig. 9. An imperfect left valve.
Hamilton group. *Skaneateles lake, N. Y.*

HAMILTON GROUP.

(PECTINIDÆ.)

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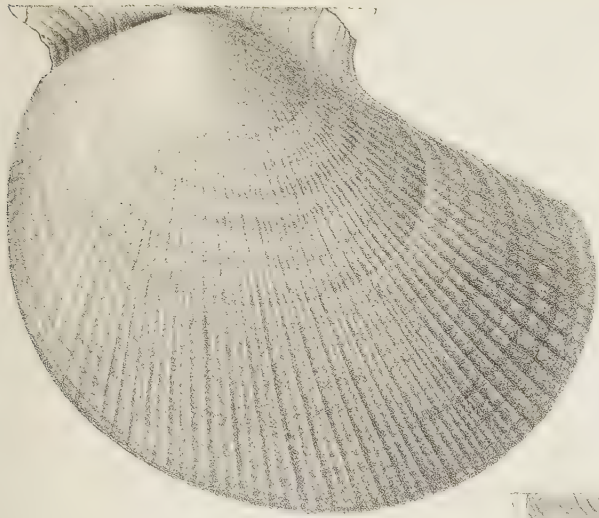

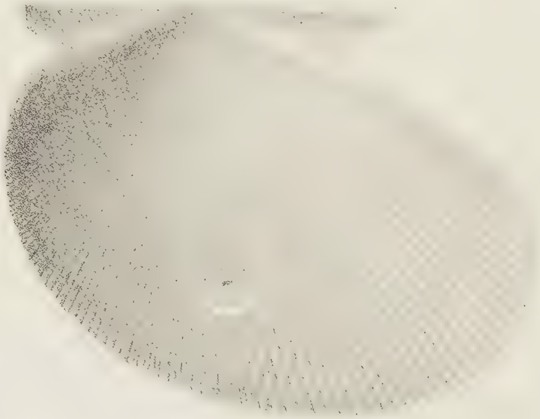

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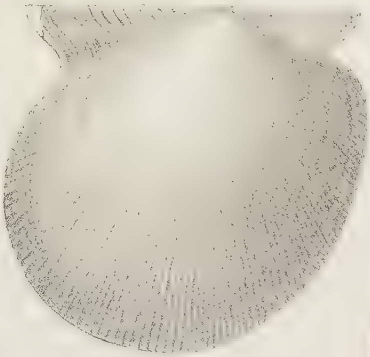

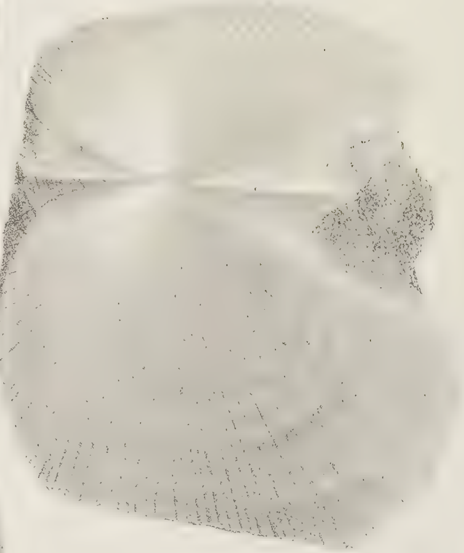

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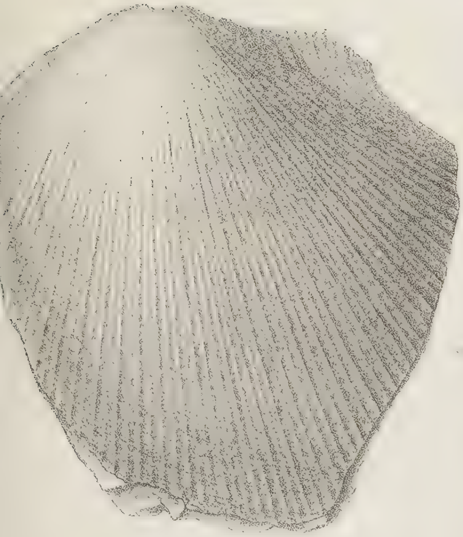

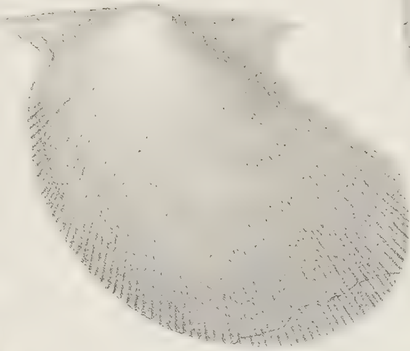

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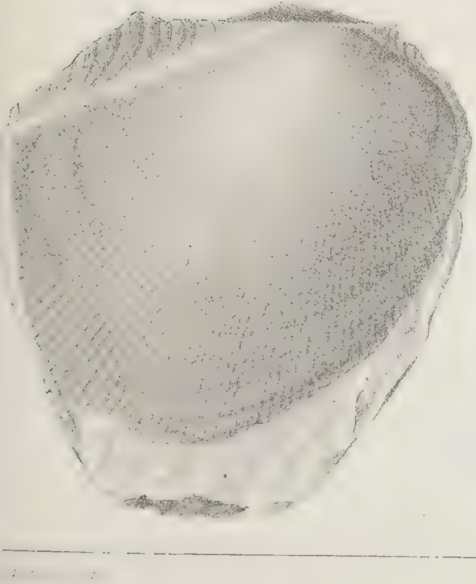

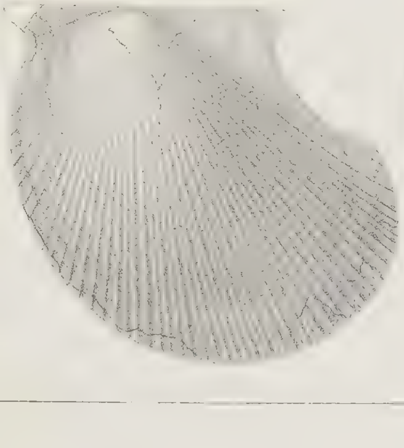

PLATE VII.

AVICULOPECTEN DUPLICATUS.

Page 17.

See Plate 81.

Fig. 1. An imperfect right valve.
Chemung group. *Hobbieville, N. Y.*

Fig. 2. A left valve, which shows the prevailing character of the species in having the anterior side longer and more extended than the posterior. The original of the species.
Chemung group. *Philipsburg, Alleghany Co., N. Y.*

Fig. 3. A somewhat larger left valve.
Chemung group. *Rockville, Alleghany Co., N. Y.*

Fig. 4. The surface of a specimen enlarged to three diameters.
Chemung group. *Rockville, N. Y.*

Fig. 5. A left valve. The outline of the figure is somewhat too high and too short, and bears an unnatural resemblance to the succeeding species.
Chemung group. *Rockville, N. Y.*

Fig. 6. A right valve. The figure represents the body too short, the striæ too sharp and the beak too obtuse.
Chemung group. *East Randolph, N. Y.*

Fig. 7. A small left valve.
Chemung group. *Rockville, N. Y.*

AVICULOPECTEN RUGÆSTRIATUS.

Page 15.

See Plate 81.

Fig. 8. A small left valve nearly entire, showing the usual form of the species.
Chemung group. *Philipsburg, N. Y.*

Fig. 9. A larger left valve of similar character to the preceding.

Fig. 10. An enlargement of the surface, showing the character of the ornamentation.

Fig. 11. A nearly entire right valve.
Chemung group. *Rockville, N. Y.*

AVICULOPECTEN CANCELLATUS.

Page 18.

Fig. 12. A right valve, showing the usual form and proportions.
Chemung group. *Philipsburg, N. Y.*

Fig. 14. A right valve preserving the ears and surface markings in a very perfect condition.
Chemung group. *Conewango, Cattaraugus Co., N. Y.*

Fig. 15. An enlargement of the preceding specimen to two diameters.

Fig. 16. The interior impression of a right valve, with radii partially preserved.
Chemung group. *Westfield, N. Y.*

Fig. 17. An enlargement of a small right valve to two diameters.
Chemung group. *Conewango, N. Y.*

Figs. 18, 19. A right valve, natural size and enlarged. The specimen is somewhat distorted from pressure, and does not represent the normal form of the shell.
Chemung group. *Rockville, N. Y.*

AVICULOPECTEN ITYS.

Page 20.

Fig. 13. The right valve described.
Chemung group. *Conewango, N. Y.*

AVICULOPECTEN SQUAMA.

Page 27.

Fig. 20. A right valve enlarged to two diameters, showing the form, ears and surface markings.
Chemung group. *Philipsburg, N. Y.*

PLATE VII—Continued.

AVICULOPECTEN DOLABRIFORMIS.

Page 26.

Fig. 21. A right valve enlarged to two diameters. The ears should show, in the figure, rays similar to those on the body of the valve. This figure is from the original specimen of the species.

Chemung group. *Philipsburg, N. Y.*

AVICULOPECTEN CONVEXUS.

Page 28.

Fig. 22. A left valve enlarged to two diameters. The anterior ear should show a slight sinus in the margin for the byssus.

Fig. 23. A profile of the preceding, showing the convexity of the valve. (Original of fig. 6, p. 264, Geolog. Rept. Fourth Dist. N. Y.)

Chemung group. *Rockville, N. Y.*

AVICULOPECTEN SIGNATUS.

Page 29.

Fig. 24. A left valve enlarged to two diameters, showing the form and surface markings. (Original of fig. 5, p. 264, Geolog. Rept. Fourth Dist. N. Y.)

Chemung group. *Rockville, N. Y.*

LYRIOPECTEN POLYDORUS.

Page 50.

Fig. 25. The left valve described. The byssal sinus should be deeper than represented.

Chemung group. *Cassadaga, N. Y.*

LYRIOPECTEN TRICOSTATUS.

Page 48.

See Plates 4 and 10.

Fig. 26. An enlargement to two diameters of a portion of the surface of a specimen of this species.

Chemung group. *Near Elmira, N. Y.*

AVICULOPECTEN TENUIS.

Page 39.

See Plate 81.

Fig. 27. A left valve, showing the form and surface markings. The specimen also shows the muscular impression and pallial line.

Chemung group. *Randolph, N. Y.*

Fig. 28. A larger specimen of the same. Another figure is given on plate 81, showing more clearly the characters of the species.

Chemung group. *Near Salamanca, N. Y.*

AVICULOPECTEN CELSUS.

Page 23.

Figs. 29, 30. A right valve, natural size and enlarged.

Chemung group. *Salamanca, N. Y.*

AVICULOPECTEN ELLIPTICUS.

Page 25.

Fig. 31. A nearly entire left valve of this species.

Chemung group. *Meadville, Pa.*

AVICULOPECTEN PATULUS.

Page 24.

Fig. 32. A small right valve as obtained from the impression in the matrix. The ears are partially restored in the figure.

Chemung group. *Salamanca, N. Y.*

Fig. 33. A large left valve, showing the characters of the shell as obtained from an impression in a fine conglomerate. The hinge-line should be represented as straight.

Chemung group. *Near Salamanca, N. Y.*

CHEMUNG GROUP.

(PECTINIDÆ.)

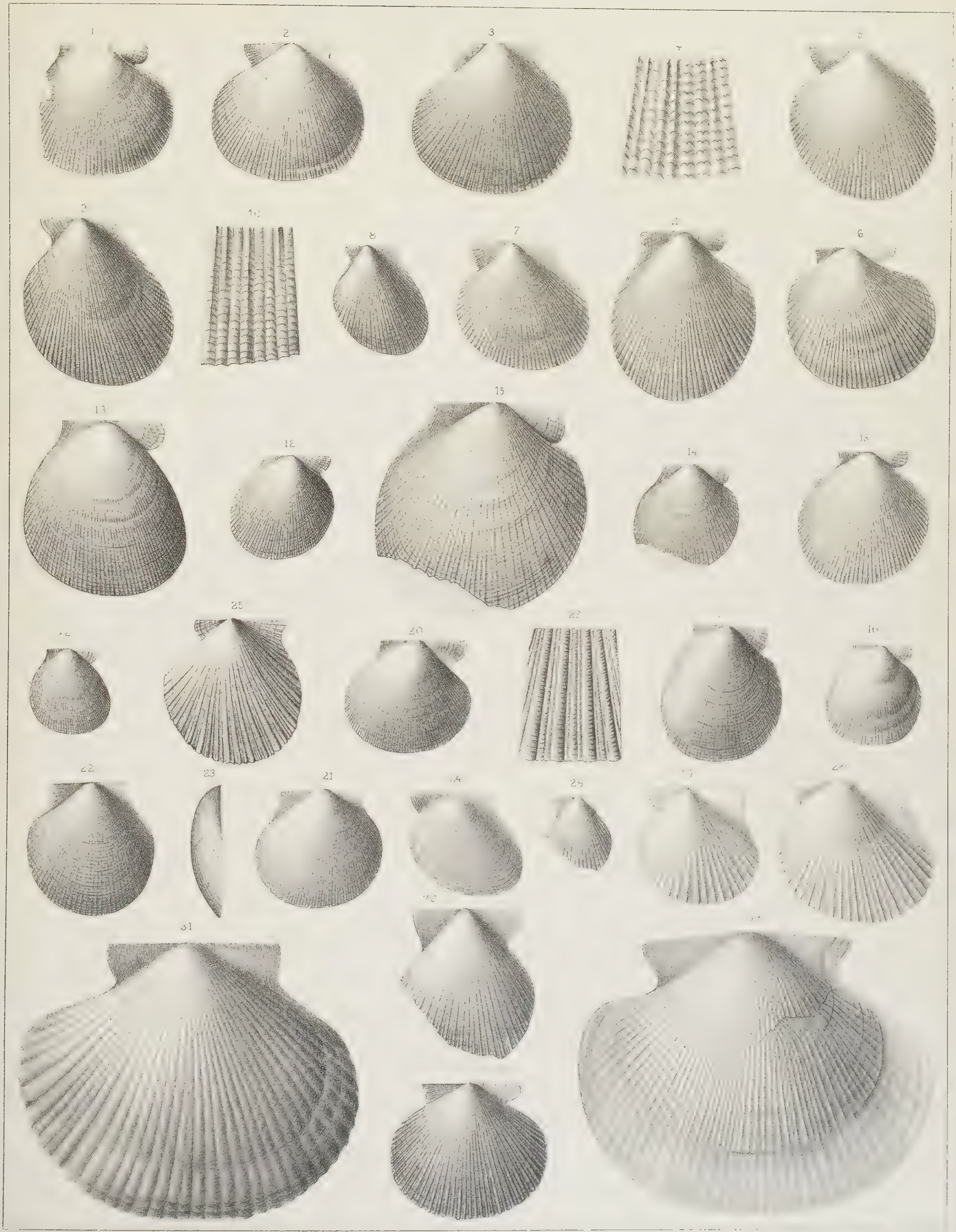

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PLATE VIII.

PTERINOPECTEN SUBORBICULARIS.

Page 80.

See Plates 24 and 82.

Fig. 1. A nearly entire left valve. The rays are strongly crenulated in the specimen and do not bifurcate as represented, but increase in number by interstitial addition.
Chemung group. *New Albion, Cattaraugus Co., N. Y.*

Fig. 2. A view of another individual. (The original of fig. 1, p. 264, Geol. Rept. Fourth Dist. N. Y.)
Chemung group. *Hobbieville, N. Y.*

PTERINOPECTEN CRENICOSTATUS.

Page 78.

See Plate 82.

Fig. 3. An imperfect left valve showing the crenulate rays.
Chemung group. *Conewango, N. Y.*

Fig. 4. A large left valve This specimen is re-drawn on plate 82, fig. 14, and represents more fully the form and surface ornamentation.
Chemung group. *Angelica, N. Y.*

PTERINOPECTEN NEPTUNUS.

Page 79.

Fig. 5. A small left valve, imperfect on the post-cardinal margin.
Chemung group. *Philipsburg, N. Y.*

Fig. 6. A large imperfect left valve.
Chemung group. *Philipsburg, N. Y.*

Fig. 7. An imperfect right valve. The specimen is obscure and is erroneously represented as a left valve.
Chemung group. *Angelica, N. Y.*

LYRIOPECTEN MAGNIFICUS.

Page 51.

Fig. 8. A large left valve obtained from an impression of the matrix. The ligamental area should be represented as longitudinally striate near the beak.
Chemung group. *Montrose, Pa.*

LYRIOPECTEN MACRODONTUS.

Page 46.

See Plate 4.

Fig. 9. A left valve, incorrectly represented as nearly circular, although in the specimen it corresponds in form with fig. 10. The ligamental area is also shown in the specimen.
Hamilton group. *Hamilton, N. Y.*

Fig. 10. A large left valve. The anterior margin is restored in the figure.
Hamilton group. *Hamilton, N. Y.*

CHEMUNG GROUP.

(PECTINIDÆ)

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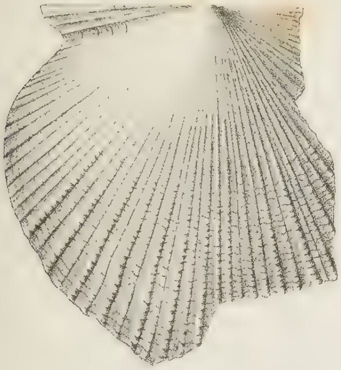

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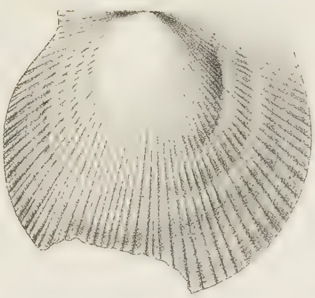

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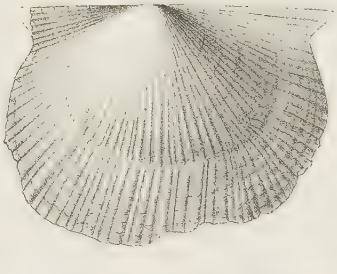

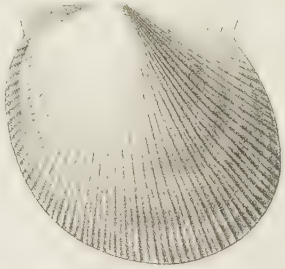

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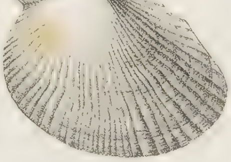

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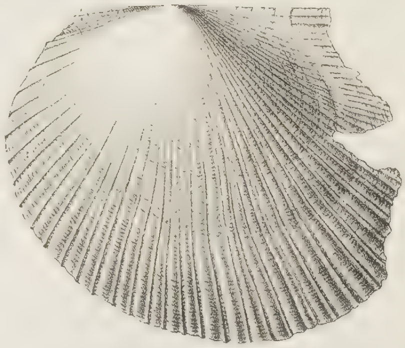

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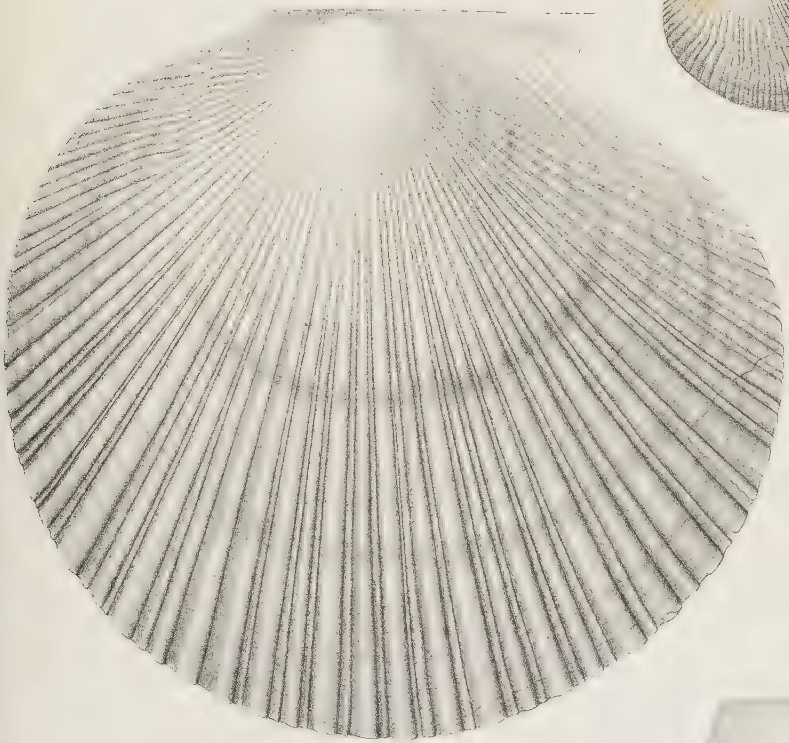

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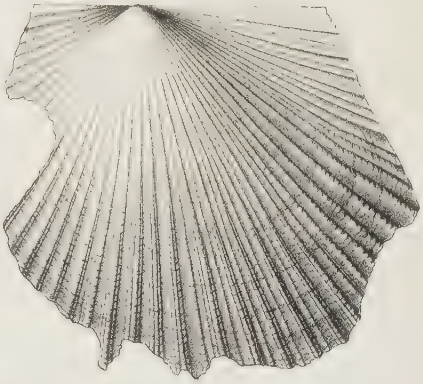

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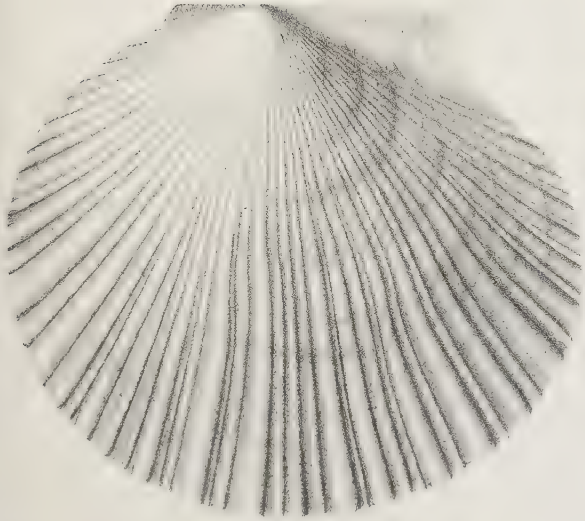

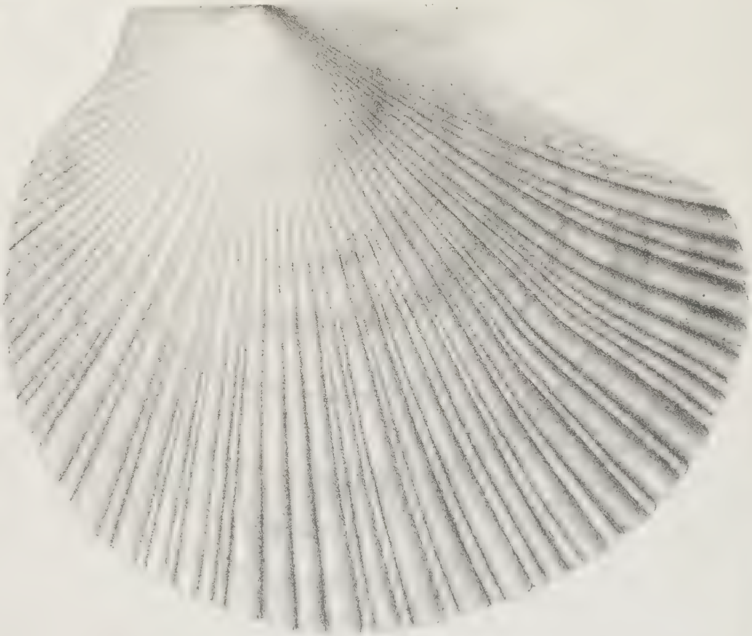

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PLATE IX.

CRENIPECTEN WINCHELLI.

Page 89.

Figs. 1, 2, 4. Small right valves showing the form of this valve and the obsolescent surface markings.

Figs. 25, 26, 27. Three left valves. Fig. 25 incorrectly represents the specimen as having the form of a right valve. The beak should turn slightly toward the left and the posterior margin should be more extended.

Fig. 28. The upper portion of a left valve, enlarged to two diameters, showing the form and surface characters of the ears, and the transverse ligamental grooves or cartilage pits.

Fig. 29. An enlargement of the surface as obtained from an impression taken in the natural mould of the exterior.

Fig. 30. An enlargement as shown in an impression of the exterior left in the matrix.

Waverly sandstone. *Newark, Ohio.*

AVICULOPECTEN (CRENIPECTEN ?) INCULTUS.

Page 30.

Fig. 3. An impression of the interior of a right valve.

Chemung group. *Olean, N. Y.*

AVICULOPECTEN CAROLI.

Page 29.

Fig. 5. A partially exfoliated left valve.

Waverly sandstone. *Newark, Ohio.*

CRENIPECTEN CRENULATUS.

Page 82.

Figs. 6–8. Three left valves varying somewhat in form and obliquity.

Chemung group. *Rockville, Alleghany Co., N. Y.*

Fig. 15. A right valve showing the form of this valve and the row of minute cartilage-pits along the hinge. The posterior ear is not sufficiently extended in the figure.

Chemung group. *Philipsburg, Alleghany Co., N. Y.*

Fig. 16. A right valve. The posterior ear in the specimen is somewhat larger than represented.

Fig. 17. An enlargement, to two diameters, showing the row of cartilage-pits along the hinge.

Chemung group. *Rockville, N. Y.*

CRENIPECTEN AMPLUS.

Page 81.

Fig. 9. A left valve showing the cartilage pits along the hinge. The posterior ear as represented is too long, giving the figure the aspect of the right valve.

Fig. 13. A large left valve. The figure should be extended fully 3 mm. on the posterior side to correspond with the specimen.

Fig. 18. An imperfect specimen, somewhat distorted from pressure, and referred to this species with some doubt.

Chemung group. *Rockville, N. Y.*

LYRIOPECTEN FASCIATUS.

Page 55.

Fig. 10. An imperfect left valve.

Fig. 11. An enlargement of a portion of the surface showing the fasciculate radii and concentric striæ.

Chemung group. *Leon, Cattaraugus Co., N. Y.*

CRENIPECTEN LEON.

Page 88.

See Plate 83.

Fig. 12. A left valve of this species. Another figure of this specimen is given on plate 83 showing more correctly the characters of the hinge and the form of the valve.

Chemung group. *Leon, Cattaraugus Co., N. Y.*

CRENIPECTEN IMPOLITUS.

Page 83.

See Plate 83.

Fig. 14. A large left valve showing the form and proportions of this species. The specimen preserves traces of distant radiating lines which are not represented in the figure.

Chemung group. *Olean, N. Y.*

CRENIPECTEN OBSOLETUS.

Page 84.

Figs. 19, 21. Left and right valves. Fig. 21 is from the original specimen of the species.

Chemung group. *Philipsburg, N. Y.*

CRENIPECTEN GLABER.

Page 85.

Fig. 20. A view of the original specimen of fig. 10, p. 264, Geolog. Rept. Fourth Dist. N. Y. 1843.

Fig. 22. A larger specimen referred with some doubt to this specimen.

Chemung group. *Alleghany Co., N. Y.*

CRENIPECTEN MICROPTERUS.

Page 86.

Fig. 23. A right valve showing the form and surface characters.

Chemung group. *Philipsburg, N. Y.*

CRENIPECTEN LIRATUS.

Page 87.

See Plate 83.

Fig. 24. A left valve. Another figure of this specimen is given on plate 83, to show the size of the ears as preserved in the specimen.

Chemung group. *East Randolph, N. Y.*

CHEMUNG & WAVERLY GROUPS.

(PECTINIDÆ)

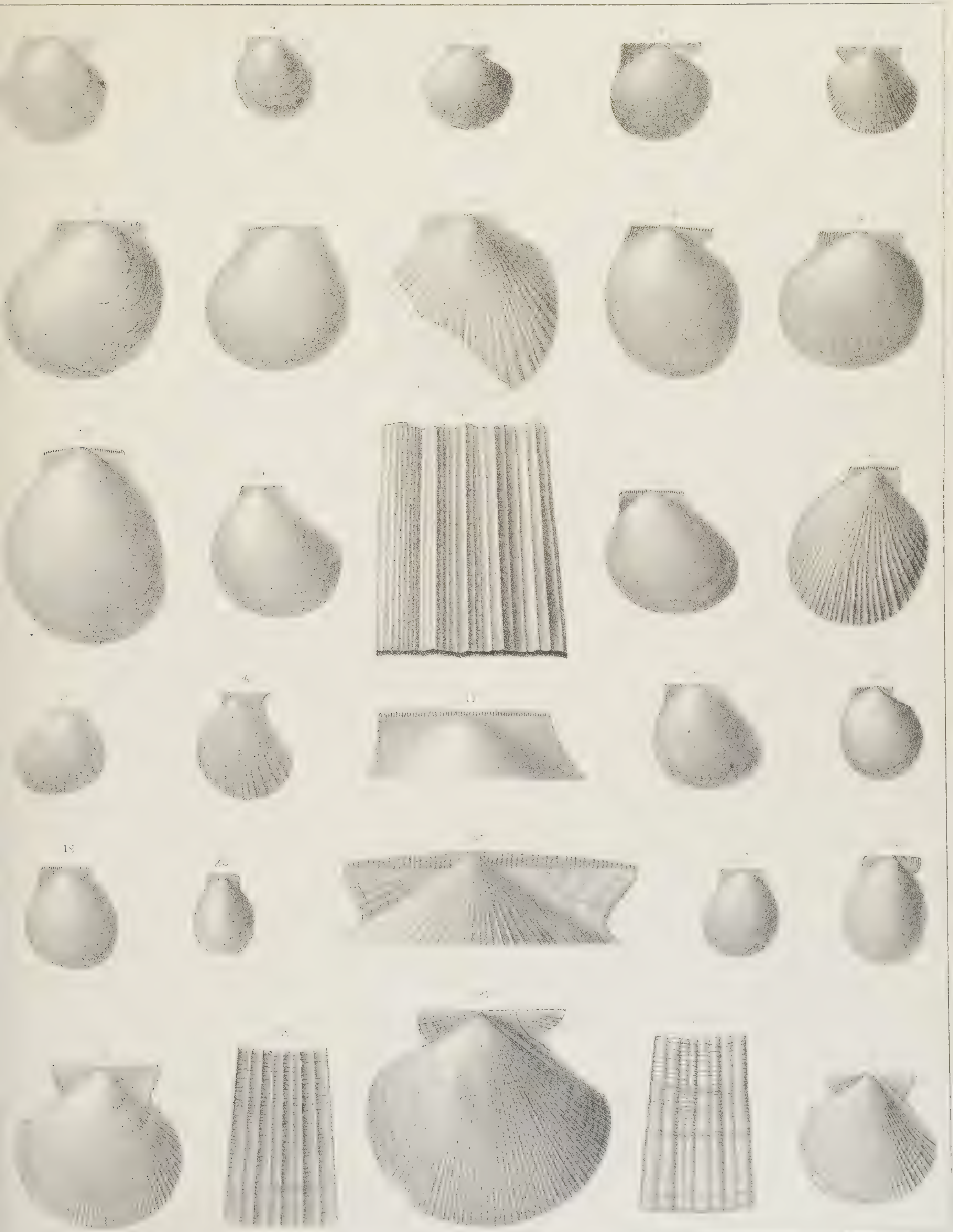


PLATE X.

Lyriopecten Priamus.

Page 54.

See Plate 82.

Fig. 1. A left valve, showing the form and surface characters. The figure should also show numerous fine rays on the posterior ear.

Fig. 2. A similar left valve, showing considerable variation in the surface characters, and strong ligamental area with a central cartilage-pit.

Chemung group. *Franklin, Delaware Co., N. Y.*

Aviculopecten striatus.

Page 22.

Fig. 3. A left valve; the original of fig. 7, p. 264, Geolog. Rept. Fourth Dist. N. Y. 1843.

Fig. 4. An enlargement of the same, showing more distinctly the characters as described.

Chemung group. *Painted Post, Steuben Co., N. Y.*

Lyriopecten anomiæformis.

Page 53.

See Plates 4 and 82.

Fig. 5. A left valve. This specimen is more correctly represented on plate 82, fig. 2.

Chemung group. *Chemung creek, N. Y.*

Lyriopecten tricostatus.

Page 48.

See Plates 4 and 7.

Fig. 6. An imperfect left valve preserving a portion of the striated ligamental area and the cartilage pit.

Chemung group. *Chemung Co., N. Y.*

Fig. 7. A small left valve with the posterior side undeveloped from accident or natural deformity.

Chemung group. *Near Elmira, N. Y.*

Fig. 8. A large left valve, showing the byssal notch on the anterior side and the comparative size of the anterior and posterior ears. The posterior ear in the specimen, shows several obscure rays and the ligamental area is strongly striated.

Chemung group. *Near Elmira, N. Y.*

Fig. 9. A fragment of a large left valve preserving a more extended posterior ear than usual. The anterior ear is too much extended in the figure and should be represented as in fig. 8.

Fig. 10. A left valve with a portion broken away, showing what appears to be the right valve beneath. The stronger radii should be continuous over the interval occupied by the other valve, and the finer lines on that valve should be of the same character as on the left valve.

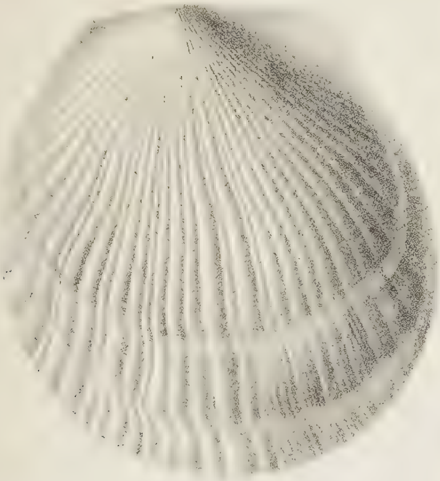
Chemung group. *Broome Co., N. Y.*

Figs. 11, 12. Two small left valves representing the form and ornamentation of the shell at this period of growth.

Chemung group. *Chemung Co., N. Y.*

CHEMUNG GROUP.

(PECTINIDÆ.)



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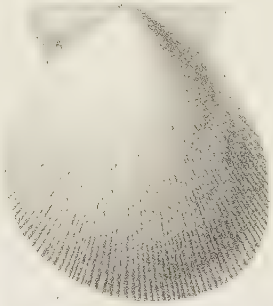

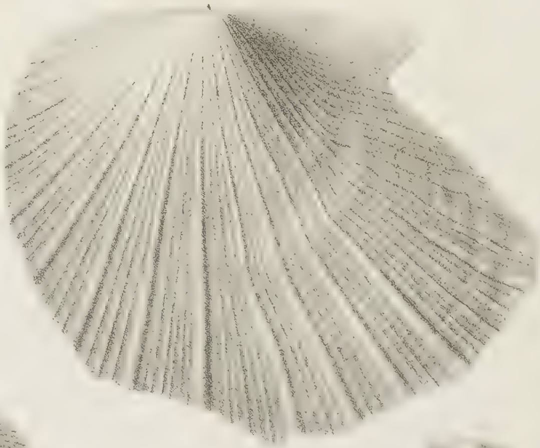

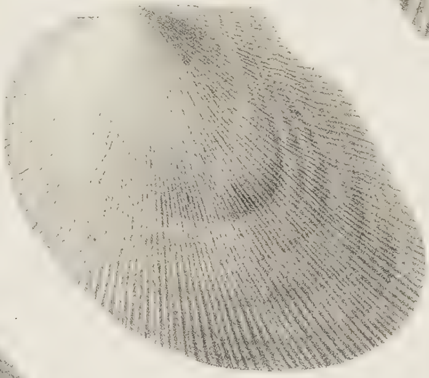

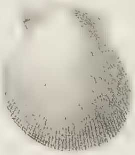

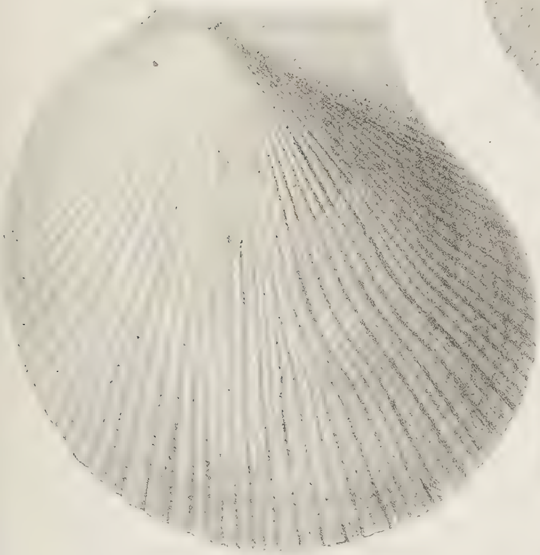

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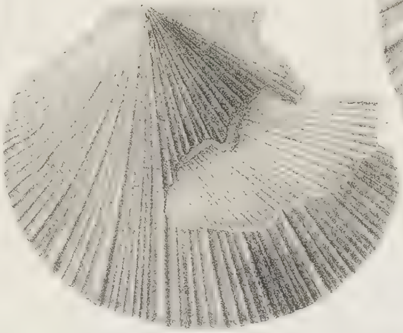

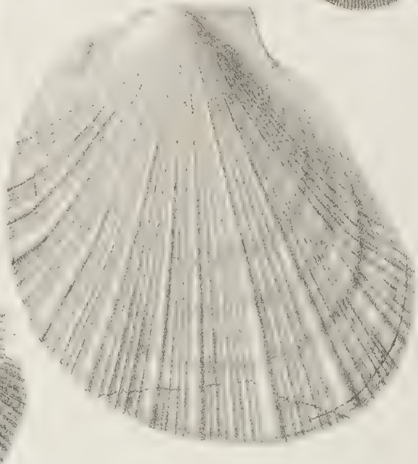

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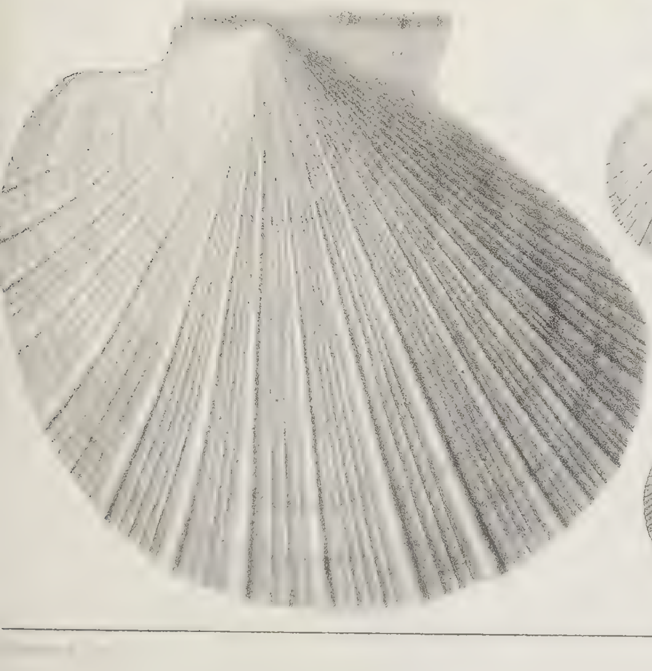

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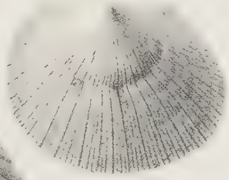

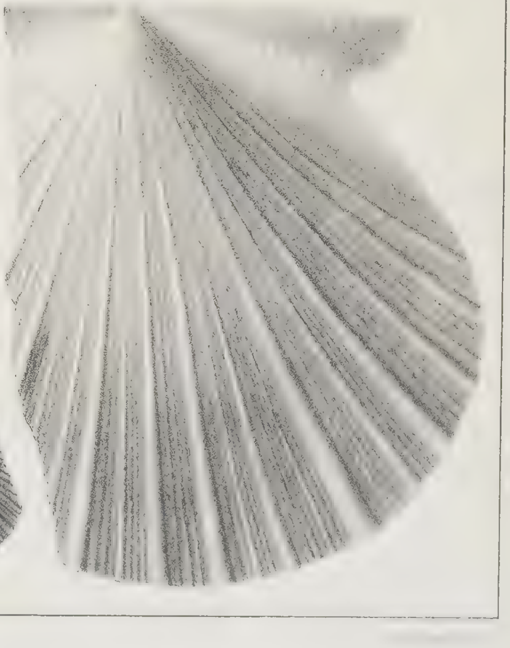

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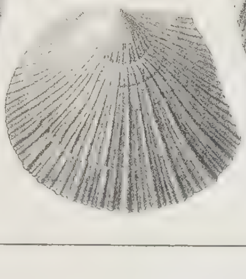

PLATE XI.

GLYPTODESMA ERECTUM.

Page 153.

See Plates 12, 13, 25, 86 and 87.

Figs. 1, 2. Two opposite valves of the same individual. Fig. 2 shows the muscular scar and also gives the comparative elevation of the beaks of the two valves. The left valve of the specimen also shows the pallial line and muscular impression, which are not represented in the figure.

Fig. 3. A more entire left valve, having the ears but little extended.

Fig. 4. A right valve having the cardinal angles much produced.

Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 5. A smaller right valve, showing one of the oblique lateral teeth.

Hamilton group. *Cazenovia, N. Y.*

Fig. 6. A right valve, showing a proportionally greater breadth and moderately extended cardinal expansions.

Fig. 7. A portion of a large left valve with very large cardinal alations.

Hamilton group. *Madison Co., N. Y.*

Fig. 8. A left valve. Another figure of this specimen is given on plate 86, fig. 6.

Hamilton group. *Cazenovia, N. Y.*

Fig. 9. A large left valve with short broad cardinal angles and unusual height. The impression of the ligamental area is longitudinally striated.

Fig. 10. A left valve with the cardinal angles narrow and unusually extended. This form is the *Avicula cruciformis*, CONRAD. Ann. Rep. p. 54, 1841. The specimen preserves the pallial line and muscular impression, which are not shown in the figure.

(AVICULIDÆ.)

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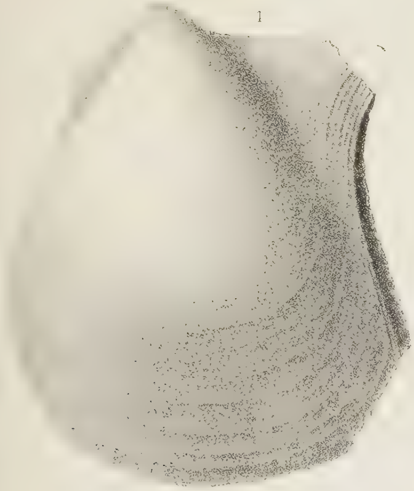

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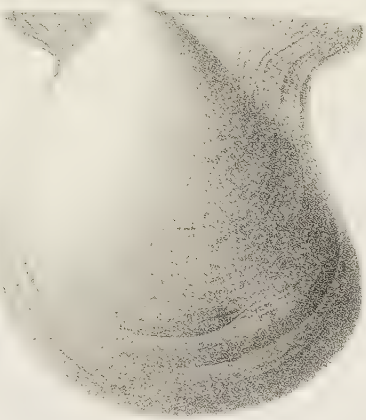

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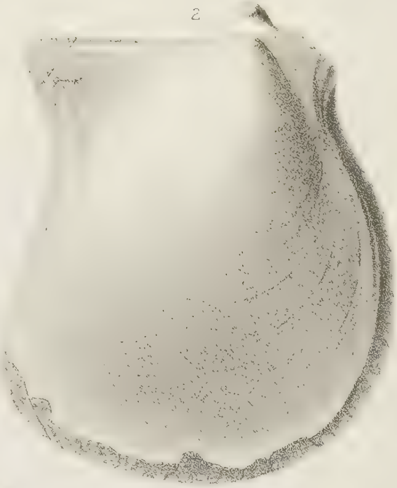

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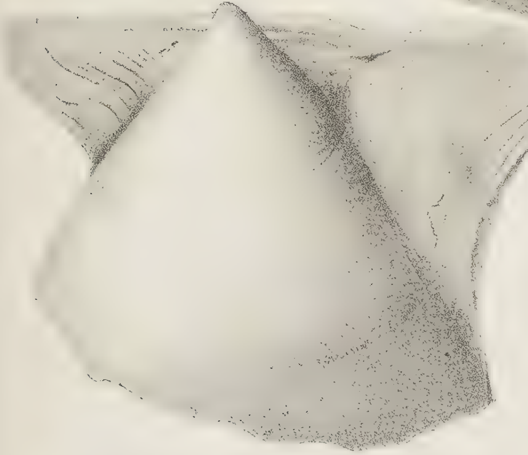

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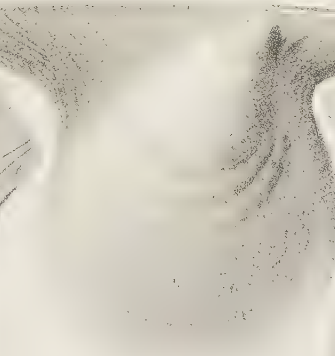

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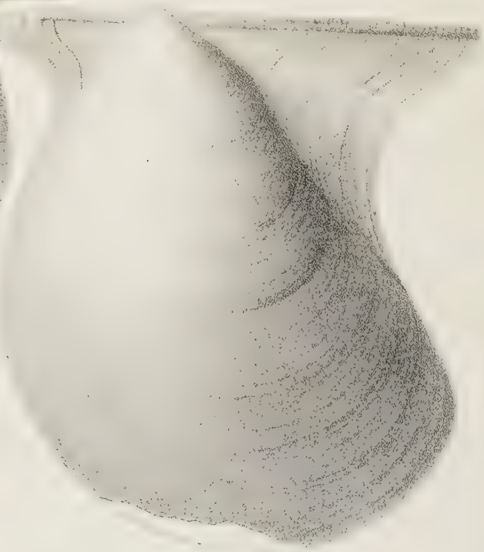

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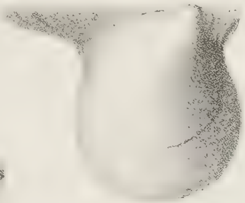

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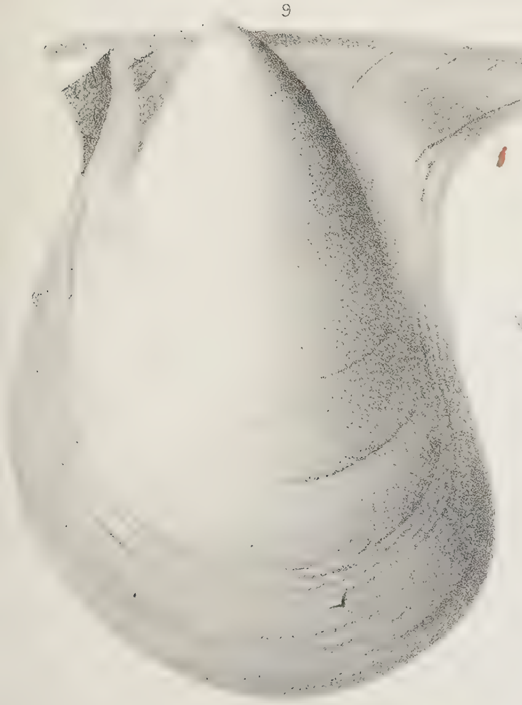

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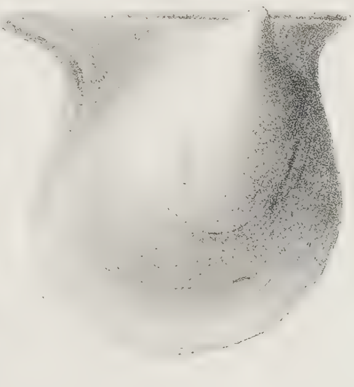

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G.B. Simpson del.

Riemann lith.

PLATE XII.

GLYPTODESMA ERECTUM.

Page 153.

See Plates 11, 13, 25, 86 and 87.

Fig. 1. A left valve.
Hamilton group. *Cazenovia, N. Y.*

Fig. 2. A view of right valve showing pallial and muscular impressions.
Hamilton group. *Cazenovia, N. Y.*

Fig. 3. A left valve preserving strong, concentric, lamellose surface markings.
Hamilton group. *Madison Co., N. Y.*

Fig. 5. A small right valve preserving the lateral teeth.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 6. A very convex left valve. The radiating lines are represented too strongly in the figure.
Hamilton group. *Hamilton, Madison Co., N. Y.*

Fig. 7. The right side of a cast showing a very distinct muscular scar and pallial line. The apparent double impression of the muscular scar is probably due to an irregular growth of this part during its advancement.

Fig. 8. A very large and erect left valve, with the cardinal angles much extended. It is of the form of *Avicula cruciformis*, CONRAD.

Fig. 9. A very large left valve with the test partially exfoliated.
Hamilton group. *Jefferson, Schoharie Co., N. Y.*

GLYPTODESMA ERECTUM, var. OBLIQUUM.

Page 155.

See Plate 13.

Fig. 4. A small left valve nearly complete in form and outline.
Hamilton group. *Canandaigua lake, N. Y.*

HAMILTON GROUP.

(AVICULIDÆ.)

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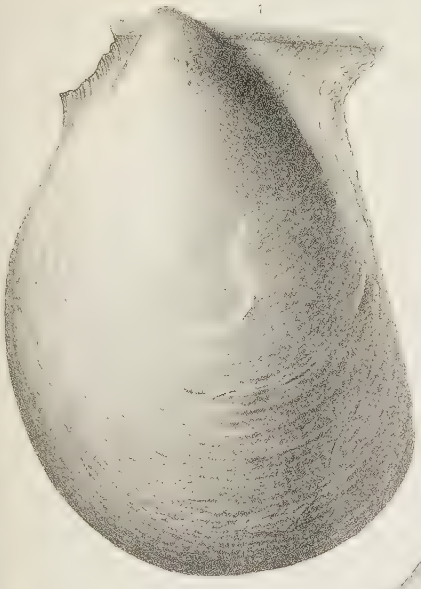

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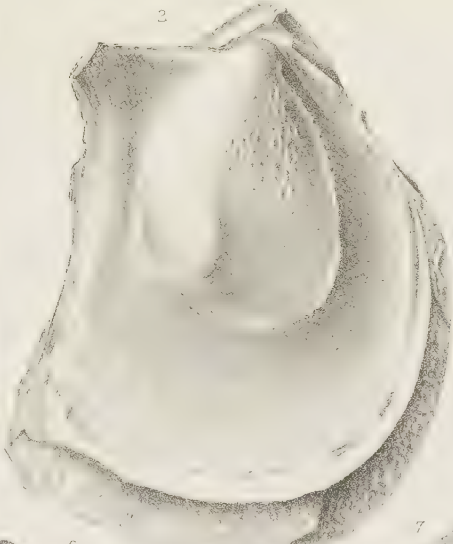

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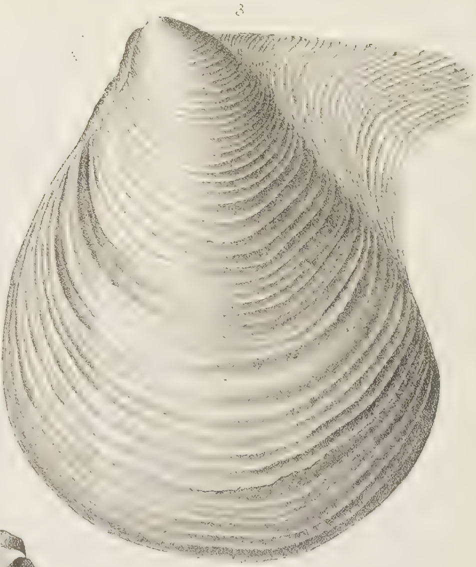

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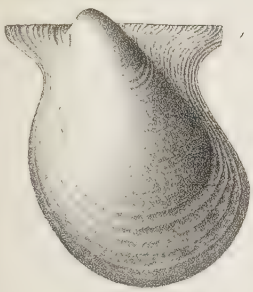

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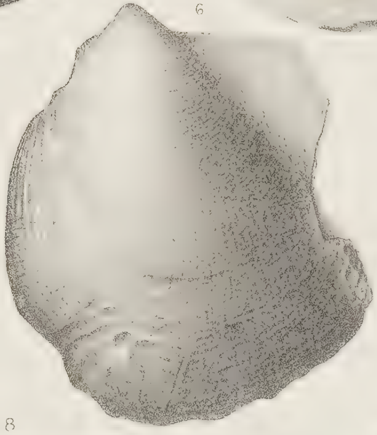

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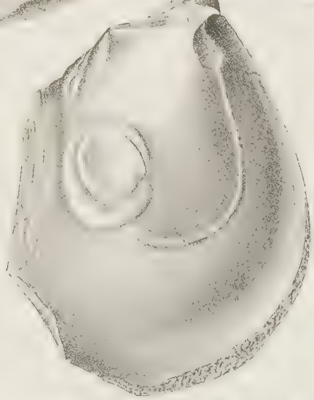

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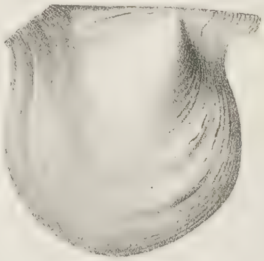

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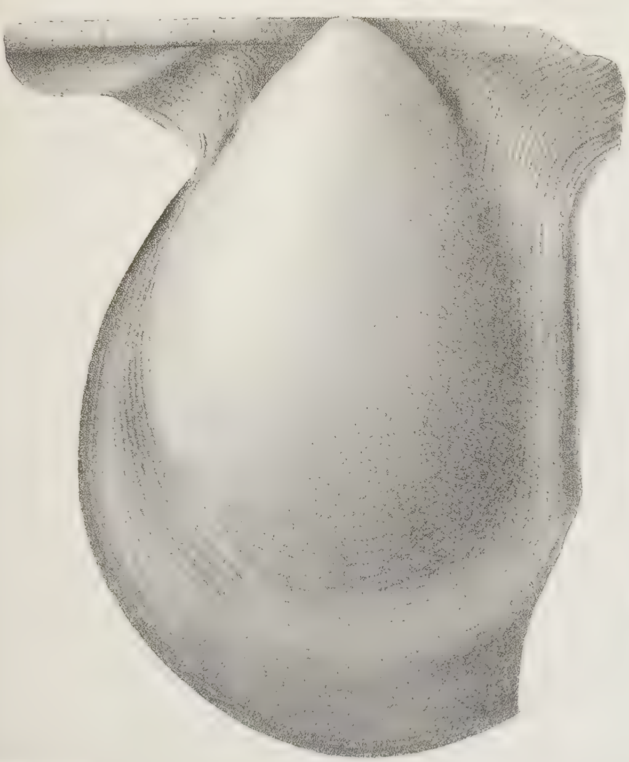

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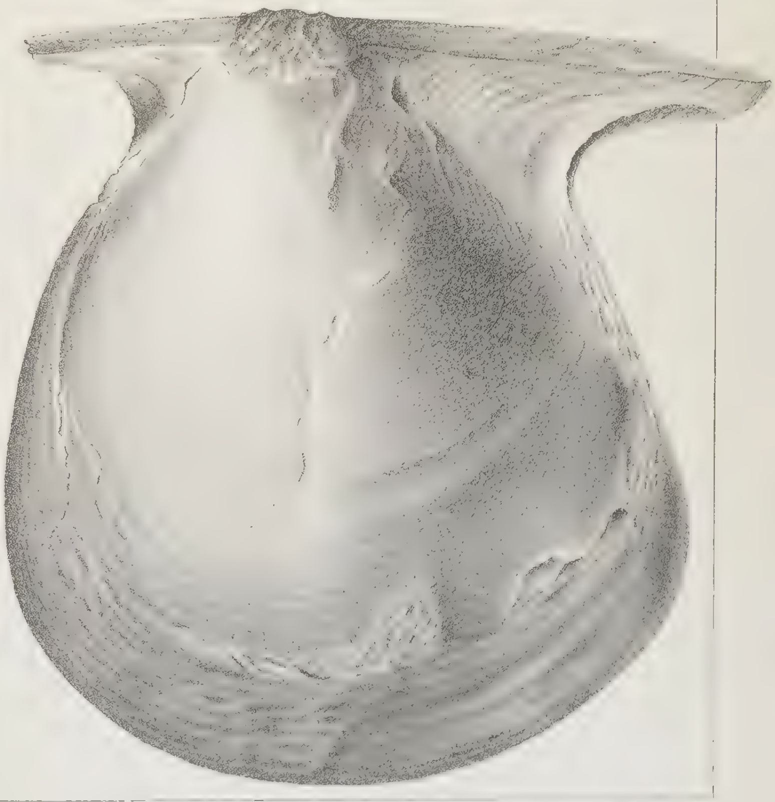

PLATE XIII.

GLYPTODESMA ERECTUM.

Page 153.

See Plates 11, 12, 25, 86 and 87.

Fig. 1. The right valve of an individual which preserves both valves. This valve retains its normal form and shows the muscular scar and pallial line, while the left valve is distorted by compression.

Fig. 2. An imperfect left valve, showing the muscular scar and pallial line.

Hamilton group. *Madison Co., N. Y.*

Fig. 3. The left side of a specimen retaining the greater portion of the shell; on the umbo are some pustules which indicate points of attachment for small umbonal muscles.

Fig. 4. The opposite valve of the preceding specimen, showing the muscular scar and pallial line.

Hamilton group. *Hamilton, Madison Co., N. Y.*

Fig. 12. An internal mould of the upper part of a left valve.

Fig. 13. The interior as obtained from an impression of the preceding, in gutta-percha, showing the cardinal folds.

Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 14. A view of the right side of a specimen retaining both valves, showing the pallial line, muscular impression, and the comparative size of the two valves.

Hamilton group. *Madison Co., N. Y.*

Fig. 15. A profile view of a specimen, showing the relative form of the valves and the depth of the shell.

GLYPTODESMA ERECTUM, var. OBLIQUUM.

Page 155.

See Plate 12.

Fig. 5. An internal mould of a left valve.

Fig. 6. A view of the interior as obtained from a gutta-percha impression.

Fig. 7. An enlargement of the cardinal portion.

Figs. 8, 9. The left and right sides of a specimen which retains the muscular scars and pallial lines, and shows the characters of the hinge in the left valve.

Fig. 10. An enlargement of the cardinal portion of the preceding specimen, showing the characters of the ligamental area and cardinal folds.

Hamilton group. *Onondaga Co., N. Y.*

Fig. 11. An imperfect left valve.

Hamilton group. *Madison Co., N. Y.*

HAMILTON GROUP.

(AVICULIDÆ.)

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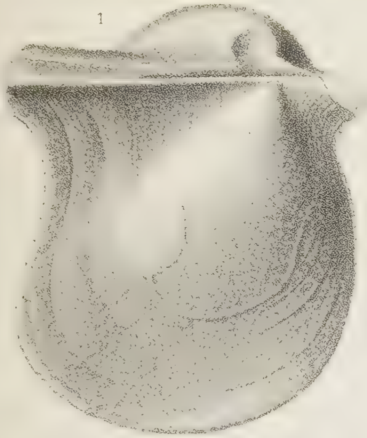

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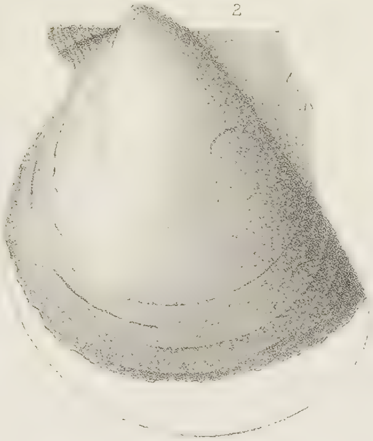

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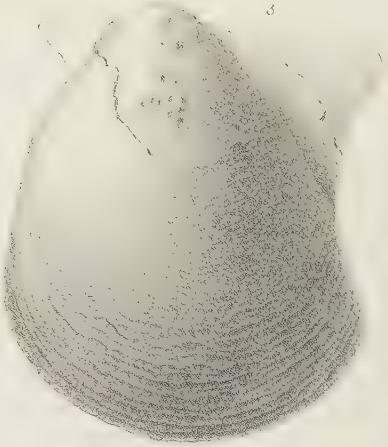

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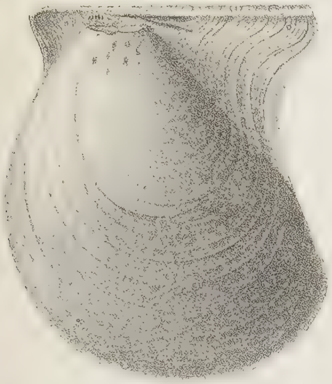

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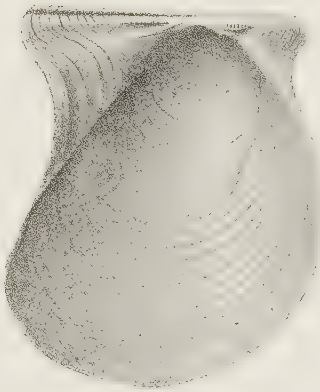

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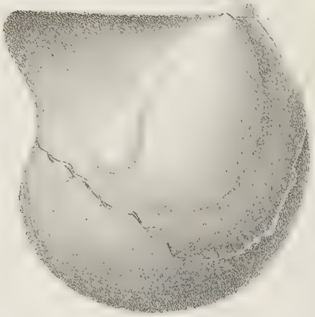

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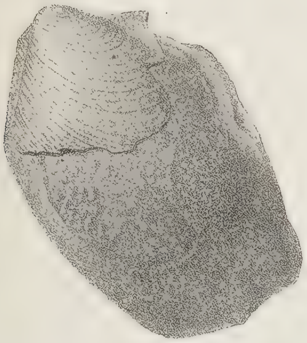

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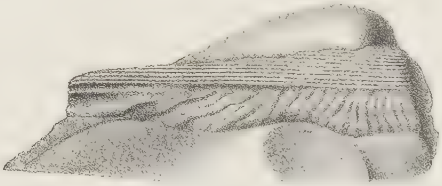

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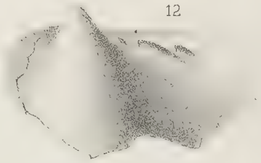

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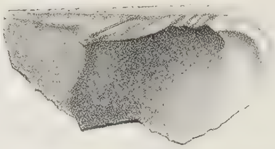

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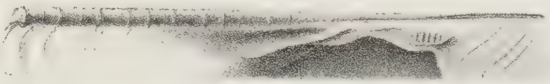

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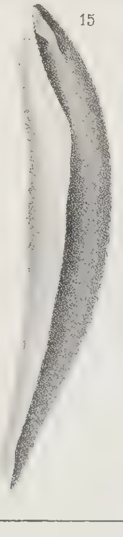

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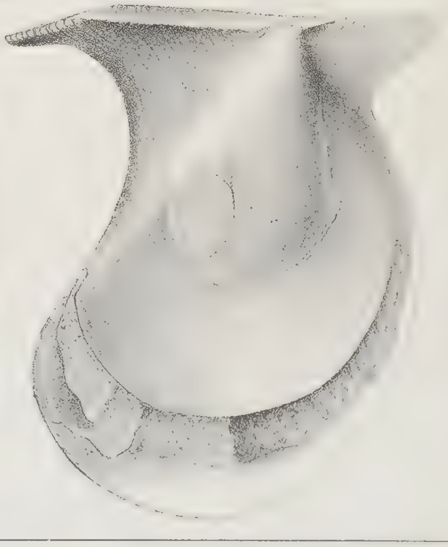

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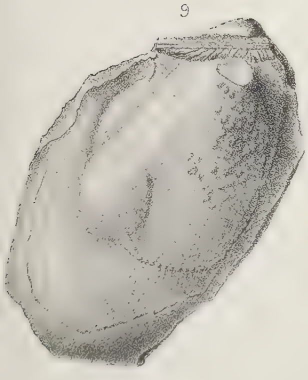

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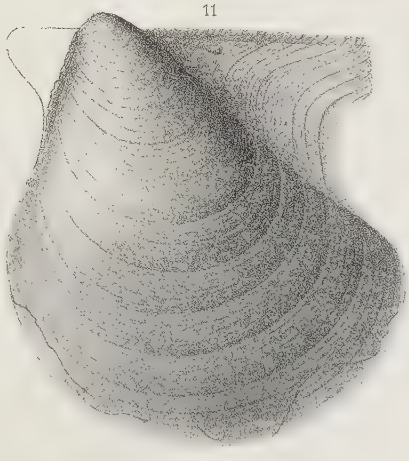

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PLATE XIV.

Pterinea flabella.

Page 93.

See Plates 15 and 83.

Fig. 1. A left valve of a small specimen of more than usual obliquity.
Hamilton group. *Eastern N. Y.*

Fig. 2. The left valve of another specimen, given to show the appearance produced by having a portion of the margin and wing removed.
Hamilton group. *Eastern N. Y.*

Fig. 3. A left valve of a well preserved specimen of medium size, showing the general form and characters. Hamilton group. *Eastern N. Y.*

Fig. 4. A left valve somewhat narrower than the preceding.
Hamilton group. *Pratt's Falls, Onondaga Co., N. Y.*

Fig. 5. A left valve having a broad body and extended wing.
Hamilton group. *Tully, N. Y.*

Fig. 6. A large imperfect specimen with an unusually large wing.
Hamilton group. *Madison Co., N. Y.*

Fig. 7. An imperfect left valve of narrow, erect form, showing the striated ligamental area.
Hamilton group. *Skaneateles lake, N. Y.*

Fig. 8. The left side of a specimen from which the shell has been removed leaving only the marks of the stronger radii in the cast, a common condition of the specimens from the hard calcareous layers.
Hamilton group. *Delphi, N. Y.*

Figs. 9–13. A series of right valves ; figs. 10, 11 and 12 being the reverse of figs. 2, 8 and 5, respectively.

Fig. 14. A profile view of the specimen figs. 8 and 11, showing the comparative depth of the valves.

Fig. 15. The internal mould of a right valve, showing the anterior and posterior muscular impressions, the pallial line with the cardinal and lateral teeth.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 16. The interior from a gutta-percha mould, showing the form of the teeth and the muscular scars.

Figs. 17, 18. The vertical and cardinal views of a natural internal mould of a fragment of a left valve showing the characters of the interior.
Hamilton group. *Otsego Co., N. Y.*

Fig. 19. The interior, as obtained from a gutta-percha impression.

Fig. 20. The internal mould of a small left valve preserving the hinge characters and muscular scars.
Hamilton group. *Otsego Co., N. Y.*

Fig. 21. The inner surface of the cardinal portion of a left valve showing the ligamental area.
Hamilton group. *Pratt's Falls, Onondaga Co., N. Y.*

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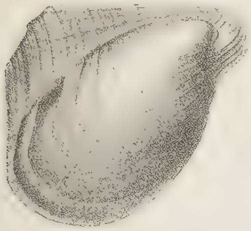

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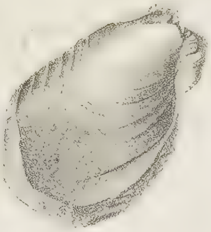

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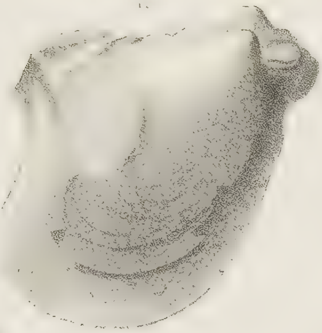

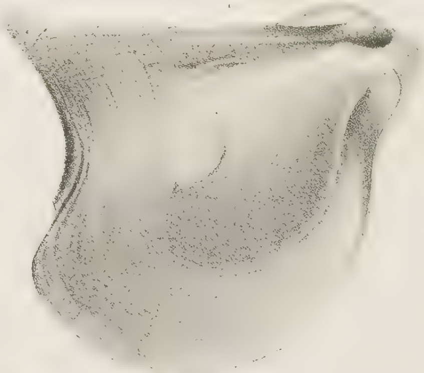

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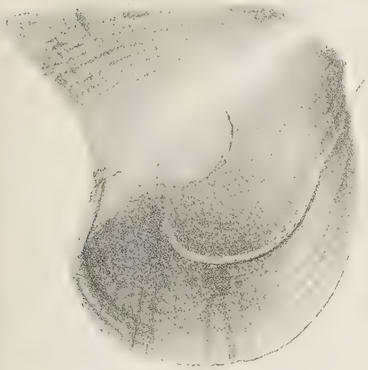

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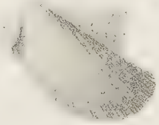

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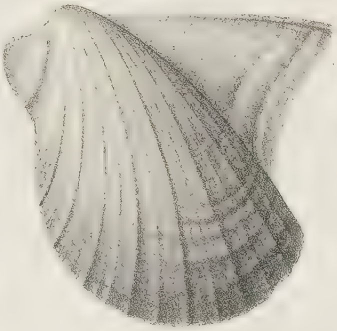

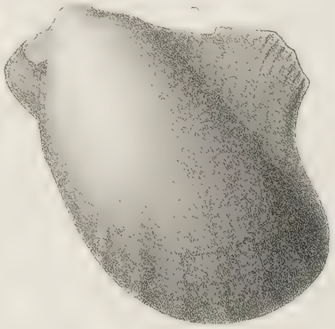

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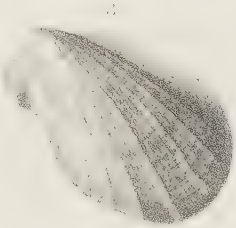

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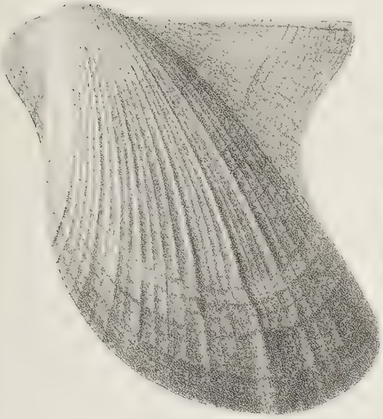

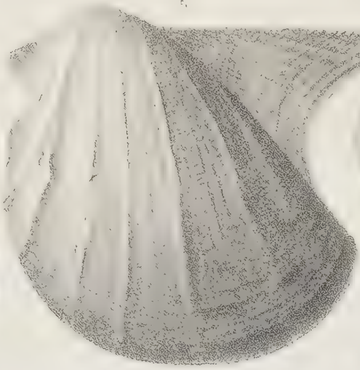

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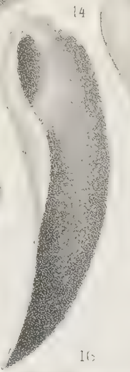

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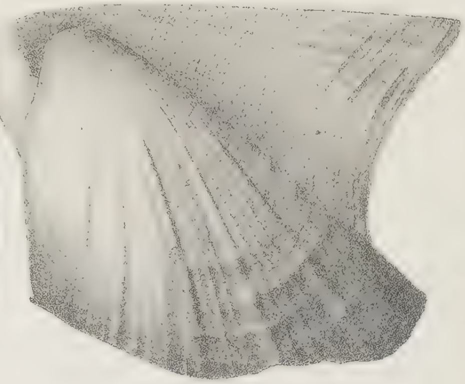

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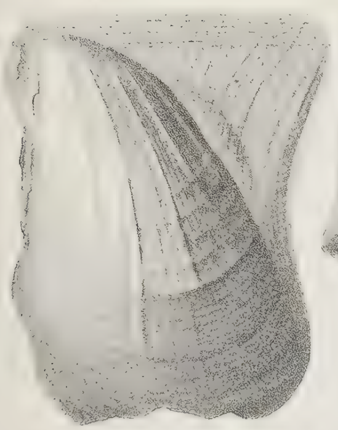

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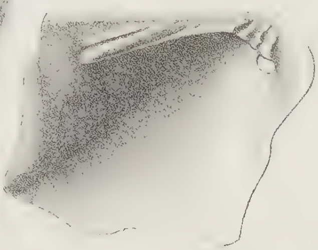

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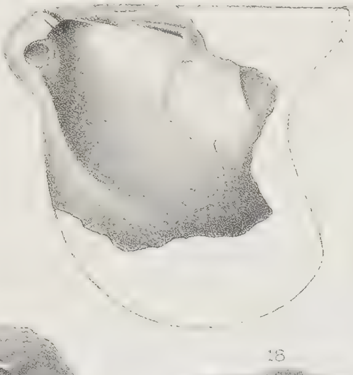

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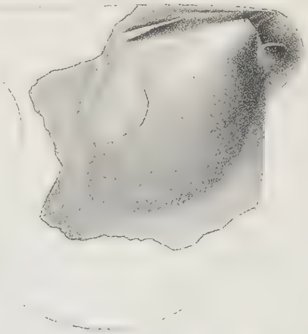

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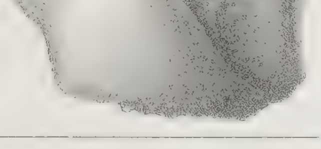

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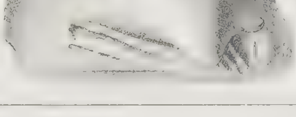

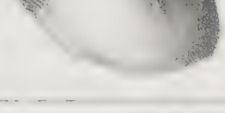

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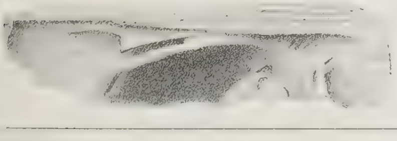

PLATE XV.

Pterinea flabella.

Page 93.

See Plates 14 and 83.

Fig. 1. An imperfect left valve.

Upper Helderberg limestone. *Stafford, Genesee Co., N. Y.*

Fig. 4. The internal mould of a small left valve, showing the hinge characters and the muscular impressions.

Hamilton group. *Otsego Co., N. Y.*

Fig. 5. The interior as obtained from an impression in gutta-percha.

Fig. 6. A left valve, having the wing unusually large and extremely extended.

Chemung group. *Mansfield, Pa.*

Fig, 8. An enlargement of surface where the intermediate radii are nearly equal.

Fig. 9. An enlargement of surface showing the alternating small radii, and strong, concentric lamellose striæ.

Hamilton group. *Skaneateles lake, N. Y.*

Fig. 10. An enlargement of a specimen preserved in calcareous shales, showing strong lamellæ and very unequal radii.

Hamilton group. *Hamburg, Erie Co., N. Y.*

The weathering of specimens like the one represented in Fig. 10 often obliterates the finer surface ornamentation, and leaves the larger rays with transverse ridges marking the place of the stronger lamellæ, giving them a nodose character. A specimen in this condition was described by Mr. Conrad as *Avicula tuberculata*, with distant tuberculated ribs and intermediate striæ. . . Ann. Rept. Geolog. Surv. N. Y., p. 117, 1838. This name should have been cited in the synonomy of *Avicula flabella*, page 93 of this volume.

Pterinea pinguis.

Page 92.

See Plate 83.

Figs. 2, 3. Casts of two imperfect left valves. The specimen fig. 2 is re-drawn on plate 83, fig. 13, to show the form of the beak and proportions of the valve.

Upper Helderberg group. *Near Columbus, Ohio.*

Pterinea dispanda.

Page 97.

Fig. 7. The left valve described, showing the form and surface characters.

Chemung group. *Mansfield, Pa.*

Leiopteria Rafinesquii.

Page 161.

See Plates 20 and 88.

Fig. 11. A left valve, slightly imperfect at the extremity of the wing. The auricle is somewhat too much extended in the figure.

Upper Helderberg limestone. *Delaware, Ohio.*

Glyptodesma occidentale.

Page 157.

See Plate 86.

Fig. 12. An imperfect left valve. This specimen is better represented on plate 86, fig. 9.

Upper Helderberg limestone. *Falls of the Ohio.*

HAMILTON GROUP

(AVICULIDÆ.)

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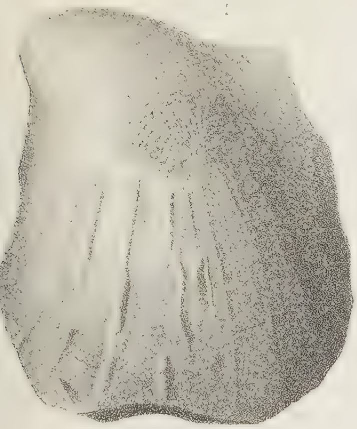

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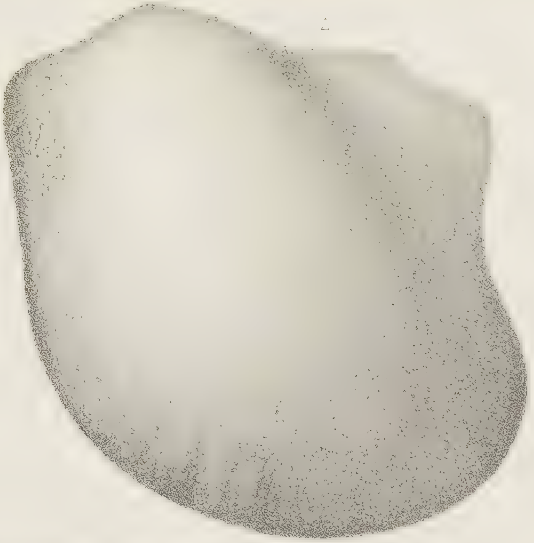

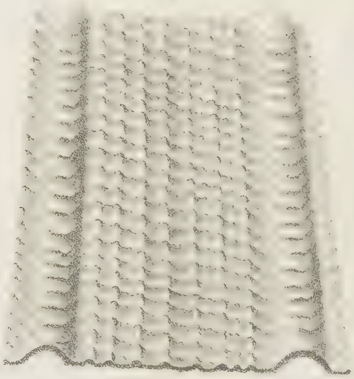

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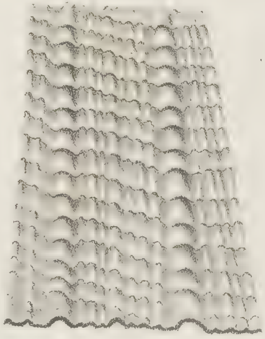

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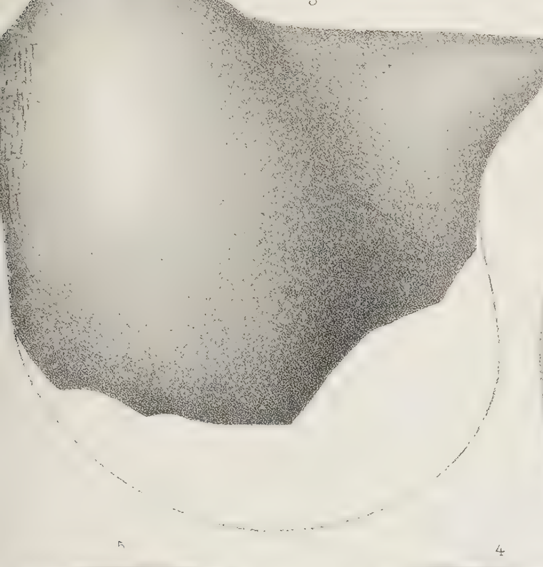

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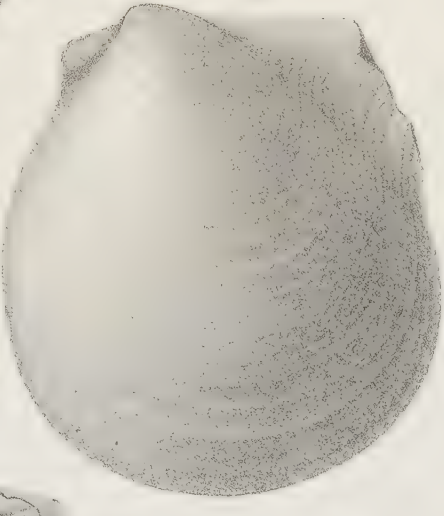

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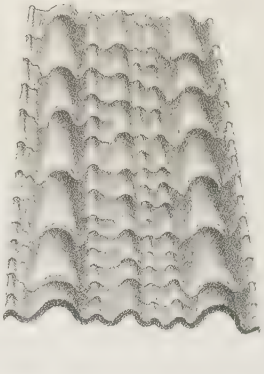

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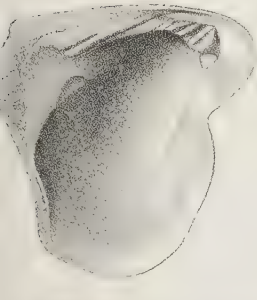

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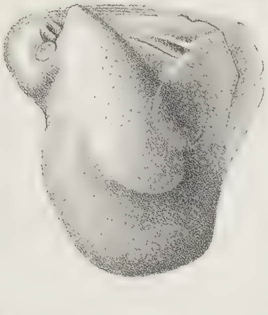

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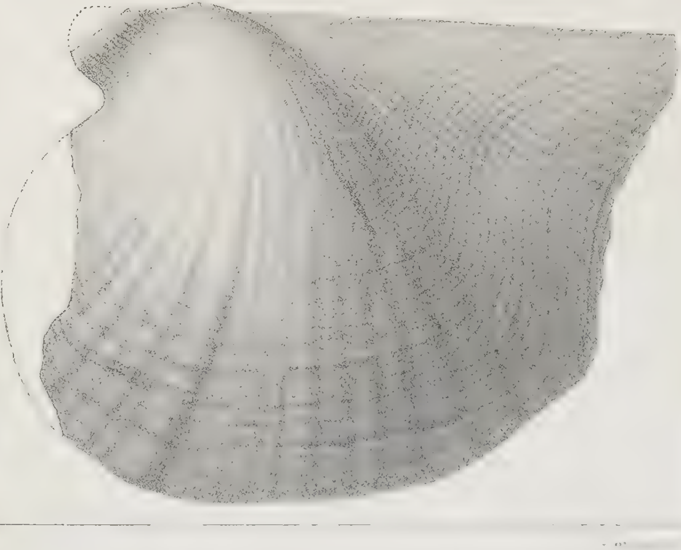

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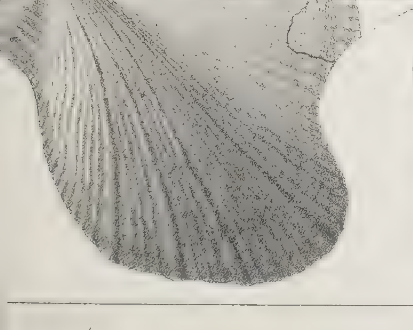

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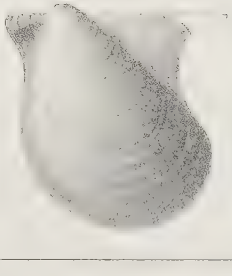


PLATE XVI.

PTERINEA CONSIMILIS.

Page 100.

See Plate 84.

Fig. 1. A small right valve, showing the strong radii on the wing and their absence over the body.
Fig. 2. A larger right valve, imperfect at the posterior margin.
Fig. 8. An imperfect left valve, showing a very broad striated ligamental area.
Chemung group. *Near Elmira, N. Y.*
Fig. 9. A similar left valve of somewhat shorter form.
Chemung group. *Near Elmira, N. Y.*
Fig. 11. A left valve, showing some irregularity in the concentric markings of the shell along the ventral margin; probably due to a natural irregularity in the growth of the shell.
Chemung group. *Near Elmira, N. Y.*

PTERINEA CHEMUNGENSIS.

Page 98.

See Plate 84.

Fig. 3. A right valve, showing the form and surface ornamentation.
Chemung group. *Chemung river, Upper Narrows, N. Y.*
Figs. 7, 10. Two left valves of very erect form.
Chemung group. *Chemung Narrows, N. Y.*
Fig. 12. A left valve, more oblique than the preceding.
Chemung group. *Chemung river, Upper Narrows, N. Y.*

PTERINEA PRORA.

Page 102.

Fig. 4. An imperfect right valve. The specimen shows the pallial line and muscular scar.
Chemung group. *Near Elmira, N. Y.*
Fig. 13. The right side of a specimen preserving a part of the right valve lying in the impression of the left one.
Chemung group. *Near Elmira, N. Y.*
Fig. 14. An impression of a right valve, retaining a portion of the left valve around the pallial margins.

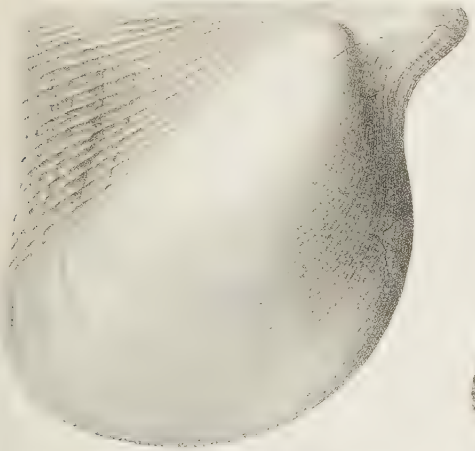
PTERINEA RIGIDA.

Page 101.

Figs. 5, 6. Two left valves, showing the characteristic form and ornamentation of the species.
Chemung group. *Chemung Co., N. Y.*

CHEMUNG GROUP.

(AVICULIDÆ)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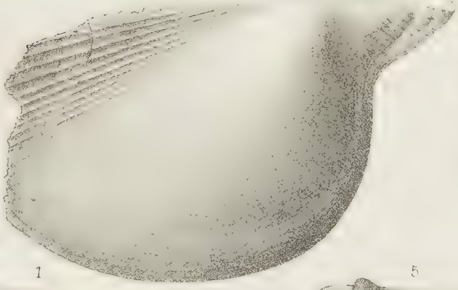
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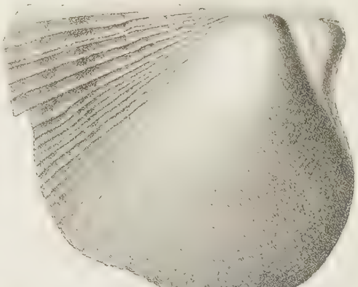
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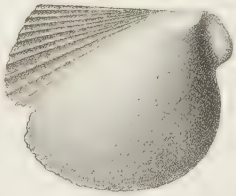
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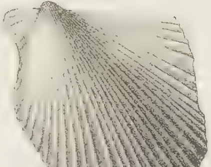
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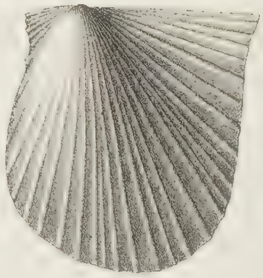
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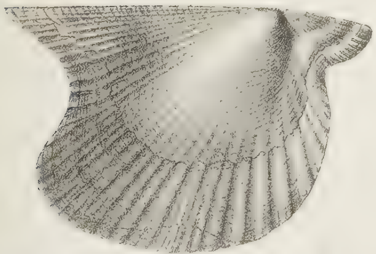
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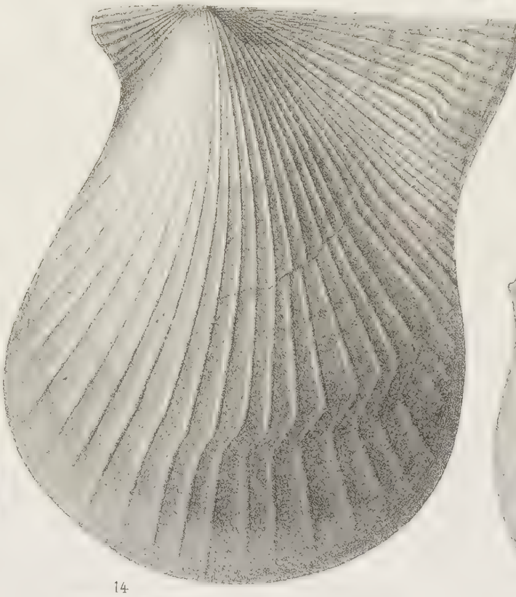
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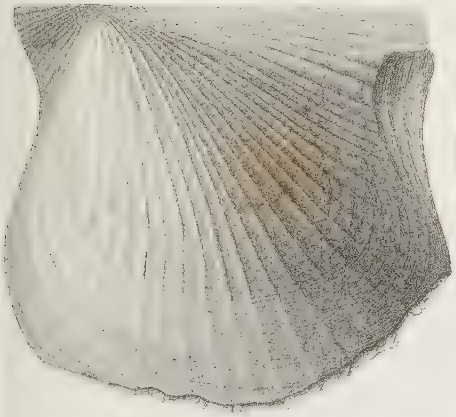
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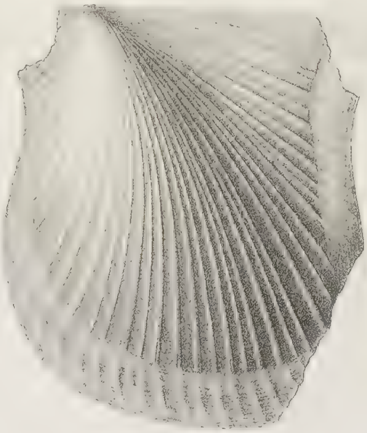
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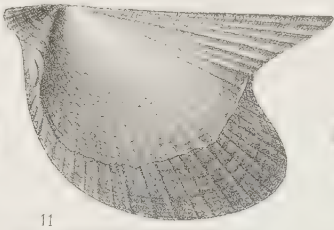
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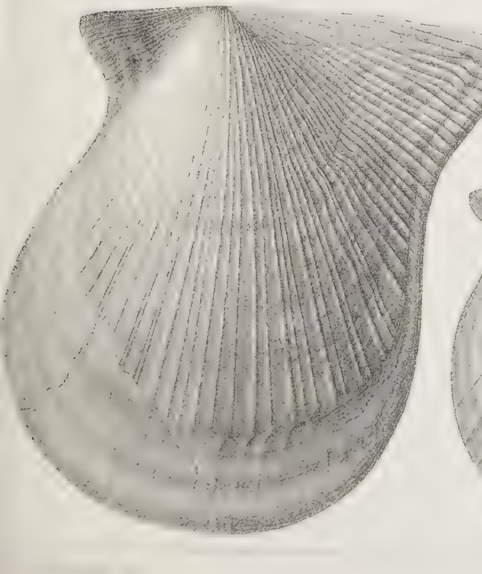
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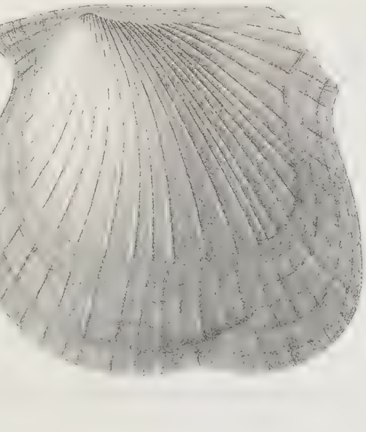
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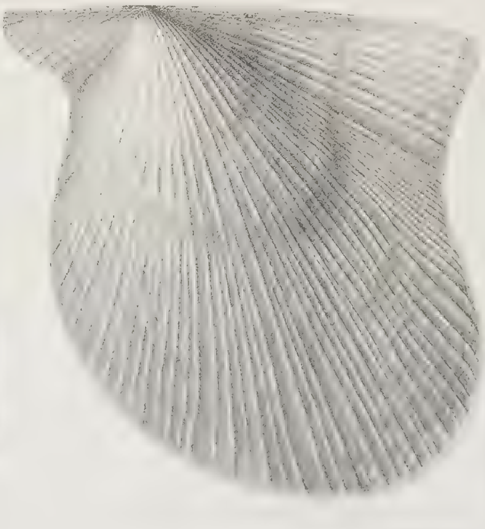
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PLATE XVII.

ACTINOPTERIA MURICATA.

Page 108.

Fig. 1. A small left valve showing the extent of the wing, × 2. The surface of the wing should show several fine radii.

Fig. 2. A larger left valve, × 2. The extremity of the wing is not sufficiently extended in the figure, and the surface has fine radii which are not represented.

Fig. 3. A left valve preserving the mucronate extensions of the radii along the ventral margin, × 2.

Marcellus shale. *Littleville, Livingston Co., N. Y.*

ACTINOPTERIA DORIS.

Page 109.

Fig. 4. A left valve of this species, enlarged to two diameters.

Marcellus shale. *East Bloomfield, N. Y.*

LEIOPTERIA LÆVIS.

Page 158.

See Plate 20.

Figs. 5, 6. Two right valves, × 2. Fig. 6 is incorrectly restored on the ventral margin and the wing.

Figs. 7–11. Left valves showing the prevailing characters of the species, × 2.

Marcellus shale. *Livingston and Erie counties, N. Y.*

LEPTODESMA MARCELLENSE.

Page 175.

Fig. 12. The left valve described, × 2.

Marcellus shale. *East Bloomfield, N. Y.*

PTERINOPECTEN HERMES.

Page 64.

Fig. 13. A small left valve. The extremity of the ear is represented too acute and the pallial margin is reflexed in the specimen.

Hamilton group. *Canandaigua lake, N. Y.*

Fig. 14. A larger left valve.

Hamilton group. *Ontario Co., N. Y.*

Fig. 15. The interior of a left valve.

Hamilton group. *Canandaigua lake, N. Y.*

PTERINOPECTEN SPONDYLUS.

Page 65.

Fig. 16. The interior of a left valve showing the spinous processes of the rays projecting from the pallial margin, enlarged to two diameters.
Hamilton group. *Canandaigua lake, N. Y.*

PTERINOPECTEN CONSPECTUS.

Page 66.

Fig. 17. The exterior of an imperfect right valve as obtained from a gutta-percha cast of the natural mould.
Hamilton group. *Skaneateles lake, N. Y.*

Fig. 18. An exfoliated left valve.
Hamilton group. *Skaneateles lake, N. Y.*

Fig. 20. A specimen preserving the fine intermediate rays of the test.
Hamilton group. *Darien, Genesee Co., N. Y.*

Fig. 21. A left valve with the test removed. The ear is represented as too oblique in the figure.
Hamilton group. *Skaneateles lake, N. Y.*

PTERINOPECTEN INTERMEDIUS.

Page 68.

See Plate 83.

Fig. 19. A left valve enlarged to two diameters.
Hamilton group. *Cayuga lake, N. Y.*

PTERINOPECTEN FILITEXTUS.

Page 67.

See Plate 82.

Fig. 22. A right valve preserving the test and showing the form of this valve.
Hamilton group. *From a boulder, Pine Valley, Chemung Co., N. Y.*

ACTINOPTERIA SUBDECUSSATA.

Page 110.

See Plate 19.

Fig. 23. A small left valve.
Fig. 25. A somewhat larger example.
Fig. 26. An individual of medium size showing the form and surface markings.
Fig. 27. A left valve, a large portion of which is broken away, showing the interior of the right valve.
Fig. 29. A large left valve.
Fig. 30. A right valve showing a greater extent of the wing than in the opposite valve.
Fig. 31. A specimen of medium size, showing the interior of the left valve occupied by a portion of the right, and representing the difference in the strength of the surface markings on the two valves.
Hamilton group. *All from Canandaigua lake, except fig. 29 which is from Bellona, Yates Co., N. Y.*

ACTINOPTERIA DECUSSATA.

Page 111.

See Plates 18, 20 and 84.

Fig. 24. A small left valve.
Hamilton group. *Dresden, Yates Co., N. Y.*

Fig. 28. A large left valve with the test removed, showing the usual form of the shell.
Hamilton group. *Canandaigua lake, N. Y.*

HAMILTON GROUP.

(AVICULIDÆ.)

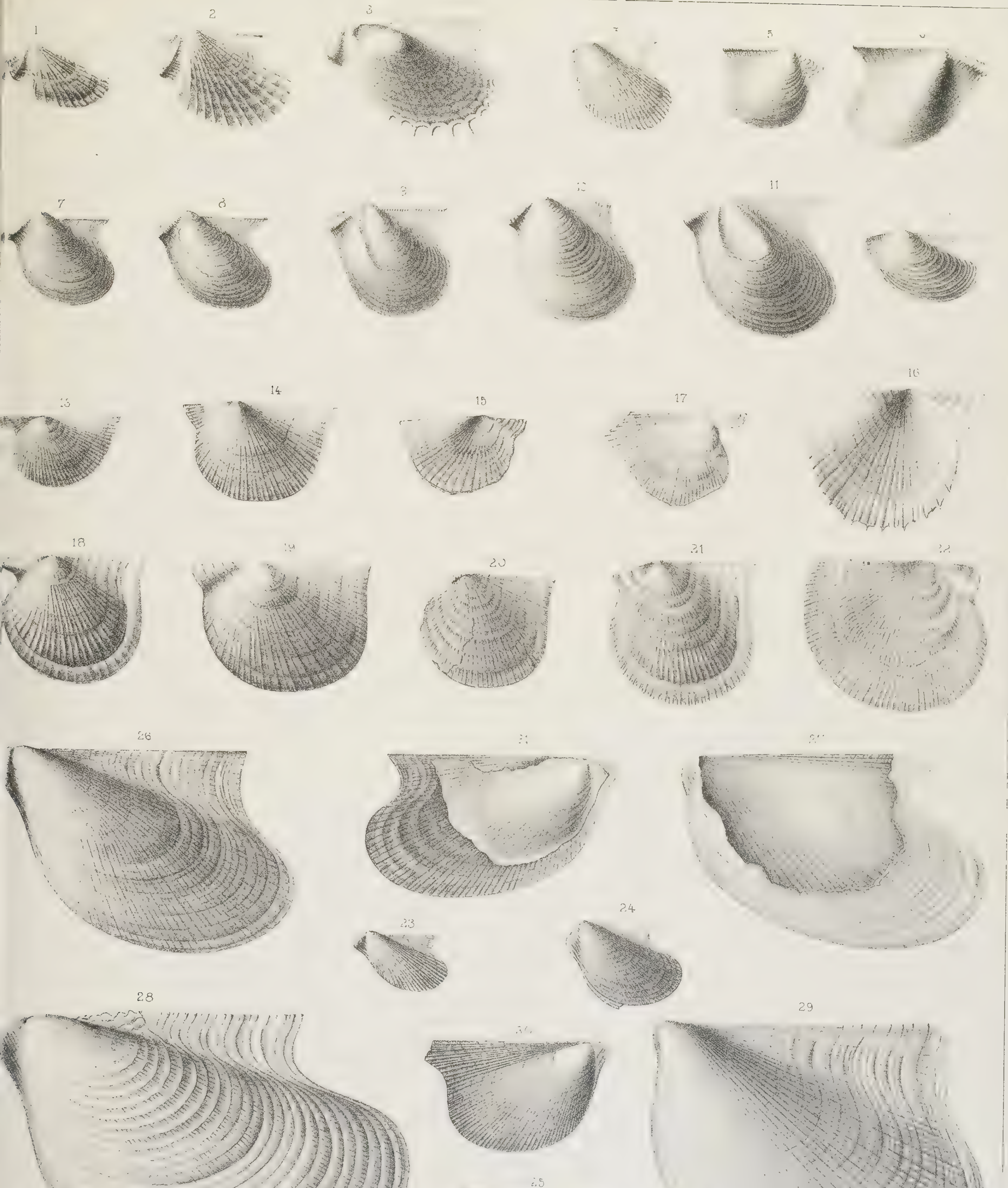

PLATE XVIII.

ACTINOPTERIA DECUSSATA.

Page 111.

See Plates 17, 20 and 84.

Fig. 1. A large right valve, preserving the lamellæ of the test.
Encrinal limestone of the Hamilton group. *Eighteen Mile creek, N. Y.*
Fig. 2. The right valve of a specimen preserving both valves. The left valve is represented in fig. 9.
Hamilton group. *York, Livingston Co., N. Y.*
Fig. 3. A right valve. The specimen preserves several rays on the wing which are not represented in the figure.
Hamilton group. *Geneseo, Livingston Co., N. Y.*
Fig 4. A small right valve showing the radii on the wing.
Hamilton group. *Ontario Co., N. Y.*
Fig. 5. A small left valve.
Hamilton group. *Canandaigua lake, N. Y.*
Fig. 6. The left valve of the specimen, fig. 4.
Fig. 7. A left valve preserving a portion of the test on the anterior end.
Hamilton group. *Livingston Co., N. Y.*
Fig. 8. A cast of a left valve.
Encrinal limestone of the Hamilton group. *Eighteen Mile creek, N. Y.*
Fig. 9. The left valve of the specimen fig. 2.
Fig. 10. A left valve showing very fine surface radii.
Hamilton group. *York, Livingston Co., N. Y.*
Fig. 11. A similar specimen of more elongate form.
Hamilton group. *Bellona, Yates Co., N. Y.*
Fig. 12. A large left valve preserving the greater portion of the test.
Encrinal limestone of the Hamilton group. *Eighteen Mile creek, Erie Co., N. Y.*
Fig. 13. A left valve enlarged to two diameters showing the characters of surface in a well-preserved specimen.
Fig. 14. A farther enlargement of the surface, to show the elevated lamellæ and the mode of increase of the radii.
Fig. 15. Cardinal view of a specimen preserving both valves partly opened.
Hamilton group. *York, Livingston Co., N. Y.*

HAMILTON GROUP.

(AVICULIDÆ)

Plate XVIII.

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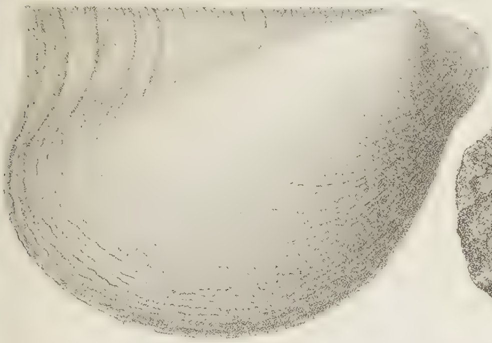

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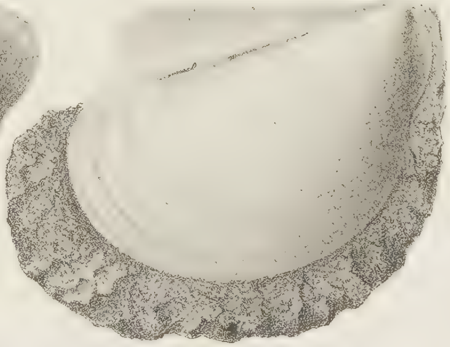

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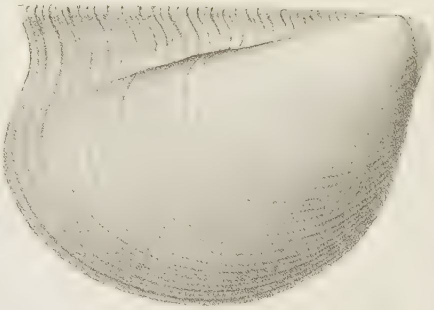

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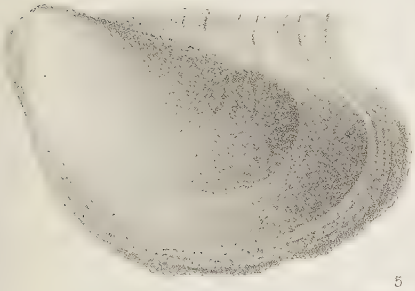

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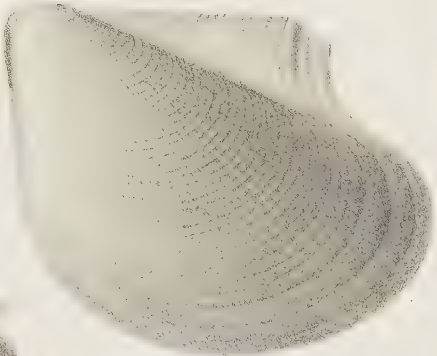

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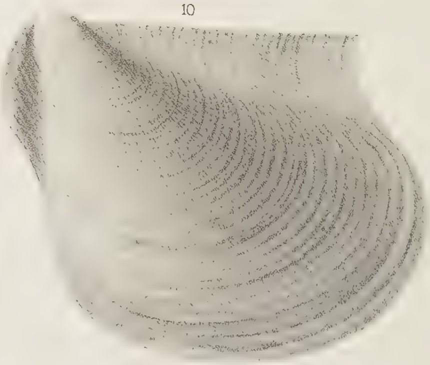

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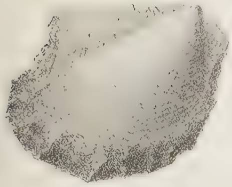

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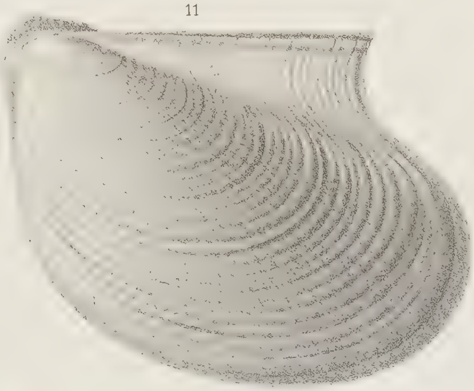

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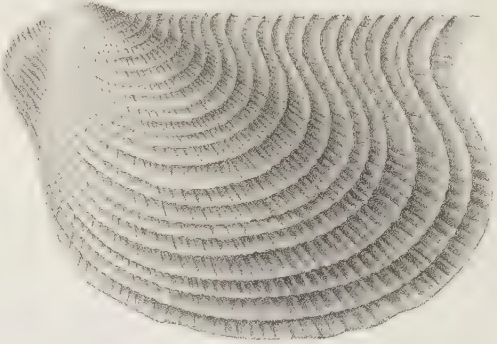

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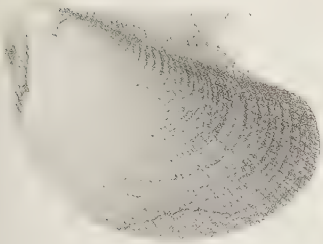

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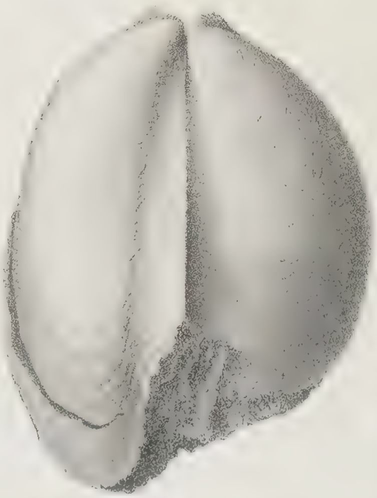

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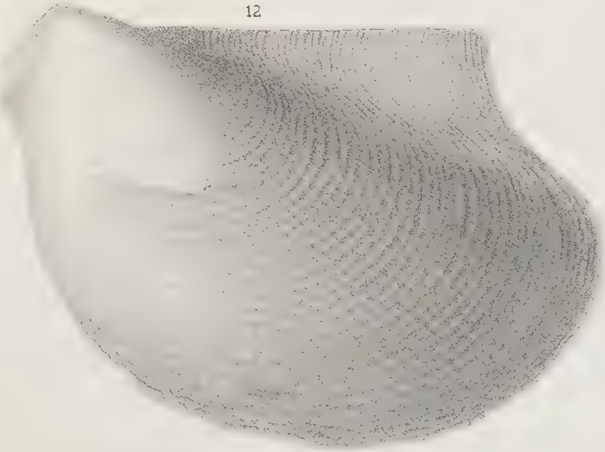

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Riemann lith.

PLATE XIX.

LEIOPTERIA DEKAYI.

Page 164.

See Plates 20 and 88.

Fig. 1. A small left valve. The specimen shows no indications of rays such as are represented in the figure. Hamilton group. *Cooperstown, N. Y.*

ACTINOPTERIA BOYDI.

Page 113.

See Plate 84.

Figs. 2, 3. Two left valves preserving the surface ornamentation.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 4. A left valve.

Fig. 5. A small left valve.
Hamilton group. *Jefferson, Schoharie Co., N. Y.*

Fig. 6. A right valve with an unusually extended wing.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 7. The exterior of a right valve, as obtained from a gutta-percha impression of the natural mould, showing the spinous processes of the lamellæ.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

The preceding figures represent the forms described as *Avicula quadrula*, Conrad.

Fig. 8. A small left valve. The ear should be represented as somewhat oblique.
Hamilton group. *Jefferson, Schoharie Co., N. Y.*

Figs. 9–11. Three left valves showing gradation in size and slight differences in form and surface characters.

Fig. 12. A small right valve enlarged to two diameters. Another figure of this specimen is given of the natural size in fig. 17, pl. 84.
Hamilton group. *Hamilton, Madison Co., N. Y.*

Figs. 13–15. Three left valves differing slightly in form and surface ornaments.
Hamilton group. *Schoharie Co., N. Y.*

Figs. 16–20. A series of left valves representing the type *A. Boydi* of Conrad.

Figs. 21–23. Right valves associated with and corresponding to the preceding.

Fig. 24. Two individuals, each retaining both valves in contact.
Hamilton group. Figs. 16 and 17 are from *Schoharie county;* the others are from *Onondaga and Madison counties, N. Y.*

Figs. 26, 27. Two large left valves.
Hamilton group. *Cazenovia, Madison Co., N. Y.*

Fig. 28. The right valve of the specimen, fig. 26, showing the comparative size of the two valves.

Fig. 29. Cardinal view of the preceding. Another view of the left valve is given on plate 84, fig. 16.

Fig. 30. A right valve showing unusually fine concentric striæ.
Hamilton group. *Cazenovia, N. Y.*

ACTINOPTERIA SUBDECUSSATA.

Page 110.

See Plate 17.

Fig. 25. A left valve showing the characters as preserved in a coarse shale.
Hamilton group. *Cazenovia, N. Y.*

ACTINOPTERIA PEROBLIQUA.

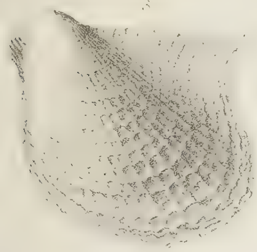
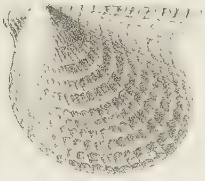
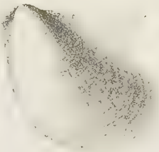
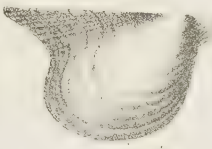
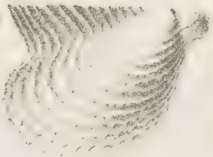
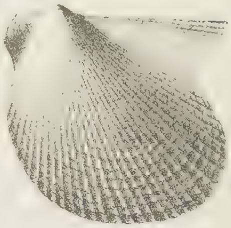
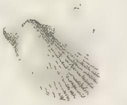
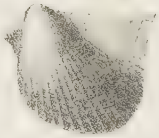
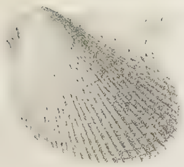
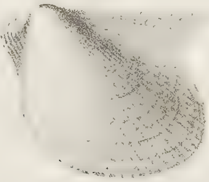
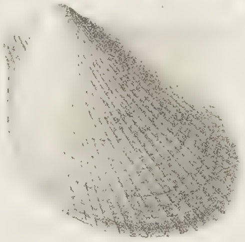
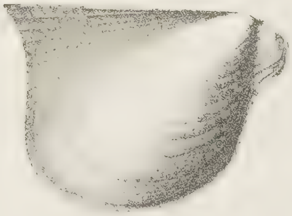
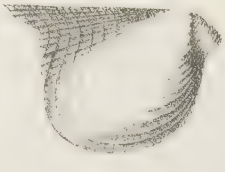
Page 116.

See Plate 84.

Fig. 31. The right valve of the specimen described. The left valve of this specimen is figured on plate 84, fig. 14. Hamilton group. *Cazenovia, N. Y.*

HAMILTON GROUP.

(AVICULIDÆ.)

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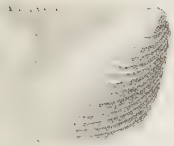

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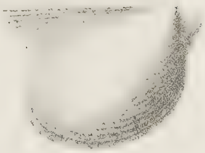
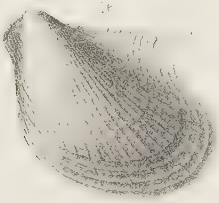
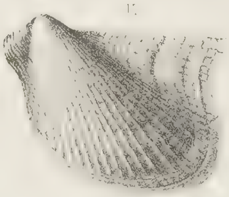
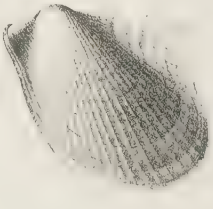

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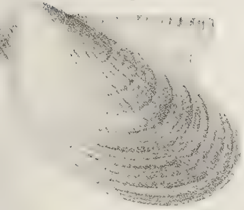
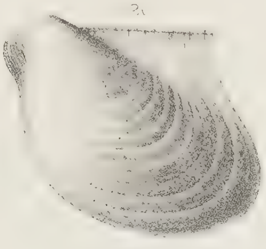
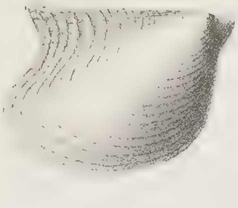
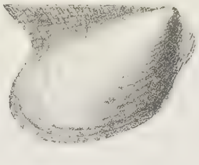
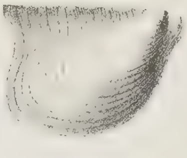

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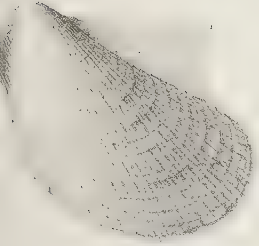
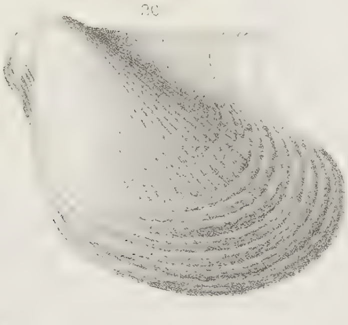
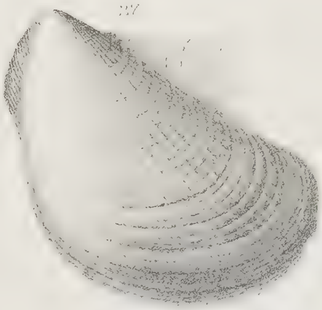
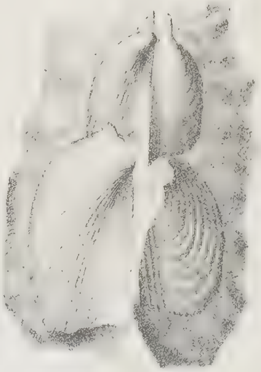
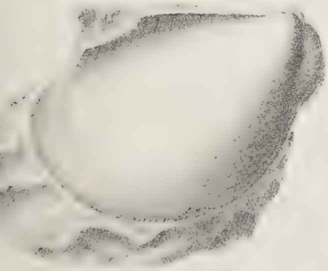

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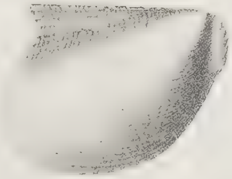
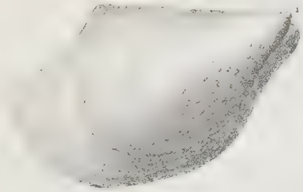
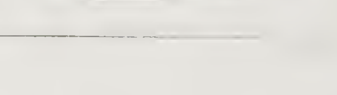

PLATE XX.

LEIOPTERIA CONRADI.

Page 159.

See Plate 88.

Fig. 1. A large left valve.
Hamilton group. *Canandaigua lake, N. Y.*

Fig. 2. A specimen of medium size showing strong concentric undulations.
Hamilton group. *Bellona, Yates Co., N. Y.*

Fig. 4. A left valve. Another figure of this specimen is given on plate 88, fig. 3.

LEIOPTERIA BIGSBYI.

Page 165.

See Plate 88.

Figs. 3, 11. Two left valves showing the form of the shell and the fine concentric striæ.

Figs. 13, 14. Two right valves.

Fig. 15. A large left valve.
Hamilton group. *Schoharie Co., N. Y.*

LEIOPTERIA LÆVIS.

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See Plate 17.

Fig. 5. A left valve enlarged to two diameters.
Hamilton group. *Ontario Co., N. Y.*

LEIOPTERIA RAFINESQUII.

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See Plates 15 and 88.

Fig. 6. A small left valve.
Hamilton group. *Skaneateles lake, N. Y.*

Fig. 7. A larger example showing regular concentric undulations of the surface.
Hamilton group. *Bellona, Yates Co., N. Y.*

LEIOPTERIA MITCHELLI.

Page 166.

See Plate 88.

Fig. 8. A left valve of this species.
Hamilton group. *From a boulder in the town of Catherine, Schuyler Co., N. Y.*

LEIOPTERIA GREENI.

Page 160.

See Plate 88.

Fig. 9. A large individual retaining both valves partly opened, showing the left valve and the cardinal view of the right valve.
Hamilton group. *Bellona, Yates Co., N. Y.*

Fig. 12. An imperfect left valve preserving a portion of the test and showing the regular concentric lamellæ.
Hamilton group. *From a boulder in the town of Catherine, Schuyler Co., N. Y.*

LEIOPTERIA OWENI.

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Fig. 10. The specimen described, showing the right valve and the umbo of the left.
Hamilton group. *Canandaigua lake, N. Y.*

LEIOPTERIA DEKAYI.

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See Plates 19 and 88.

Figs. 16–18. Three left valves differing somewhat in form and obliquity.
Hamilton group. *Otsego Co., N. Y.*

ACTINOPTERIA DECUSSATA.

Page 111.

See Plates 17, 18 and 84.

Fig. 19. A right valve. The specimen shows the pallial line and muscular impression which features are not represented in the figure.
Hamilton group. *Madison Co., N. Y.*

HAMILTON GROUP.

(AVICULIDÆ.)

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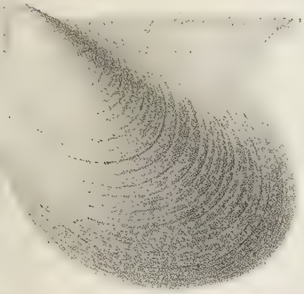

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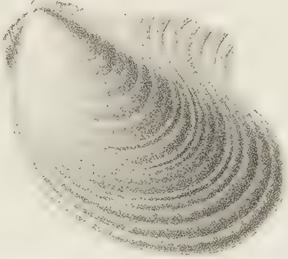

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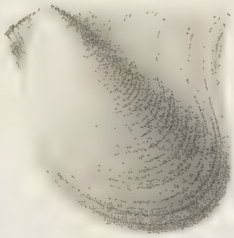

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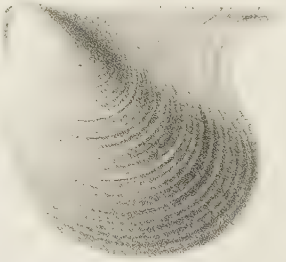

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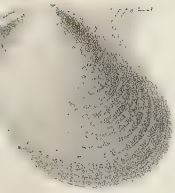

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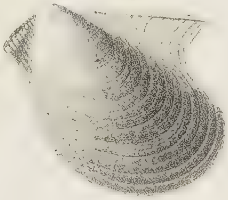

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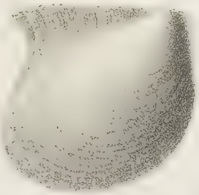

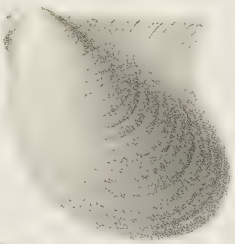

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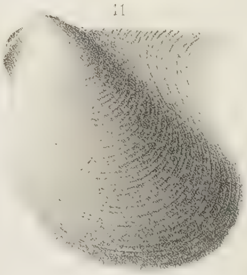

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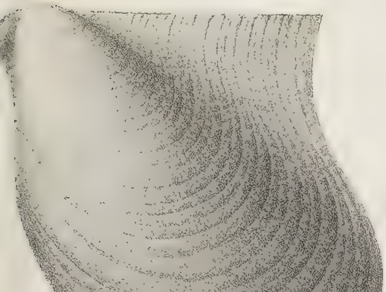

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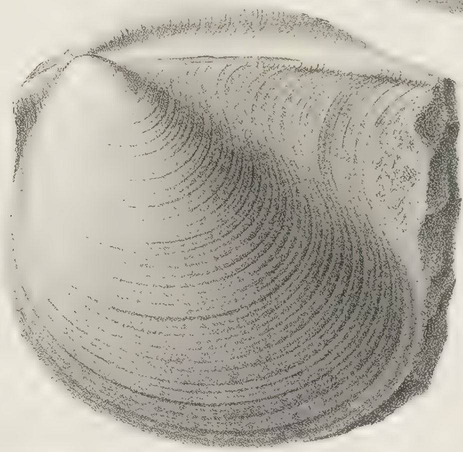

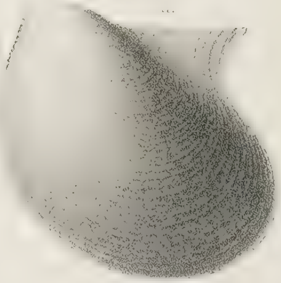

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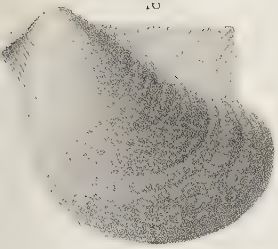

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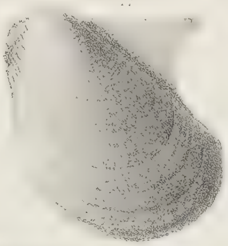

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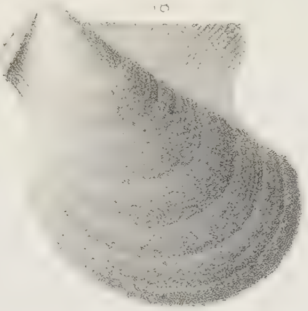

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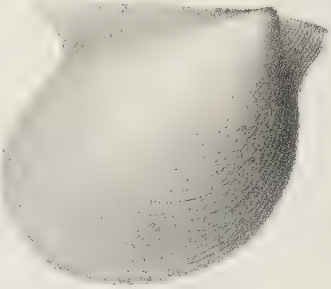

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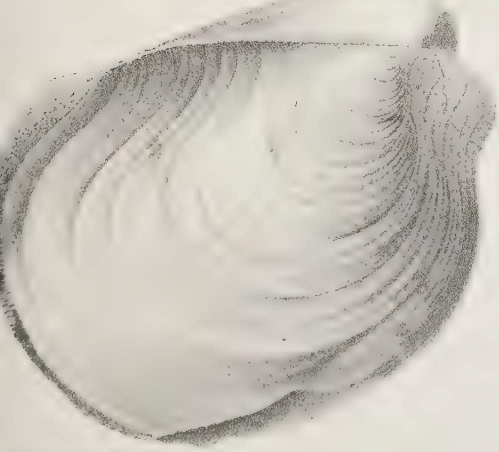

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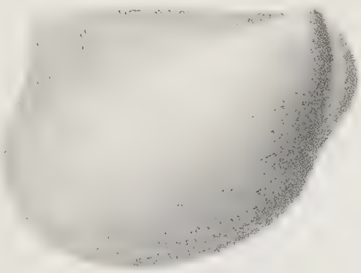

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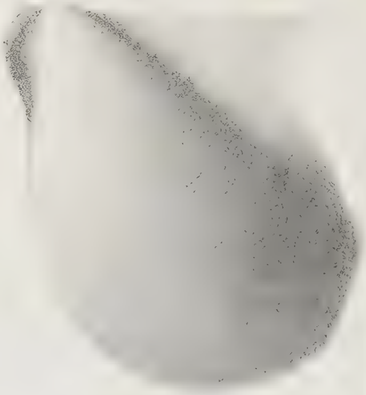

PLATE XXI.

LEPTODESMA ROGERSI.

Page 176.

Fig. 1. A small block showing two right valves of this species, × 2.
Fig. 2. A large right valve preserving the mucronate extension of the wing, × 2.
Figs. 3–8. A series of left valves varying in size and general proportion. Fig. 7 also shows a right valve.
Fig. 9. A right valve of somewhat higher form than usual.

Hamilton group. *Norwich, Chenango Co., N. Y.*

LEPTODESMA SPINIGERUM.

Page 177.

See Plate 89.

Figs. 10–13. Four left valves showing slight variations of form and length of spine.

Chemung group. *Painted Post, Steuben Co., N. Y.*

LEPTODESMA LONGISPINUM.

Page 179.

See Plate 89.

Fig. 14. A left valve. This specimen is the original of fig. 3, p. 262, Geol. Rept. Fourth Dist. N. Y.
Figs. 17–19. Three right valves.

Chemung group. *Painted Post, N. Y.*

LEPTODESMA ROBUSTUM.

Page 181.

See Plate 89.

Figs. 15, 16. Two left valves showing the form and convexity of the shell. The striæ on the post-umbonal slope should extend farther along this slope than represented, before recurving into the wing.
Fig. 20. A right valve.

Chemung group. *Painted Post, N. Y.*

LEPTODESMA POTENS.

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See Plates 22 and 89.

Fig. 21. A right valve referred to this species.
Chemung group. *Conewango, Cattaraugus Co., N. Y.*
Fig. 30. A left valve showing the form and proportions of the shell.
Chemung group. *Portville, Cattaraugus Co., N. Y.*

LEPTODESMA PROTEXTUM.

Page 183.

Figs. 22, 23. A left and a right valve in the same association.
Chemung group. *Chemung river, Upper Narrows, N. Y.*

LEPTODESMA SOCIALE.

Page 187.

Figs. 24, 25. Two left valves showing the form of the shell and surface ornamentation, × 2, from fig. 27.
Chemung group. *Conewango, Cattaraugus Co., N. Y.*
Fig. 26. An enlarged view of a right valve from the same block.
Fig. 27. A fragment of stone with several valves of this species, natural size.
Fig. 28. An impression of a left valve, retaining a part of the right valve in place.
Chemung group. *Conewango, Cattaraugus Co., N. Y.*
Fig. 33. A fragment of rock with a right and a left valve showing their comparative form.
Chemung group. *Broome Co., N. Y.*
Fig. 34. A right valve of larger size and broader form, associated with fig. 33. The extremity of the wing should be produced farther than is represented. This and the preceding figure are referred to this species with some doubt.

LEPTODESMA MORTONI.

Page 190.

See Plate 89.

Figs. 29, 31. Two left valves varying somewhat in size and proportions.
Fig. 32. A right valve. This specimen is redrawn on plate 89, fig. 10.
Chemung group. *Portville, Cattaraugus Co., N. Y.*

LEPTODESMA LICHAS.

Page 232.

See Plate 91.

Figs. 35-37. Three left valves.
Fig. 38. A large left valve of this species. The cardinal extremities should be produced in the figure to correspond with fig. 37.
Fig. 39. A small right valve.
Chemung group. *Philipsburg, Alleghany Co., N. Y.*

LEPTODESMA LEPIDUM.

Page 195.

See Plate 89.

Fig. 40. A left valve, as seen lying in the rock, and with a part of the right valve in place. The concavity of the margin of the wing is represented as too deep.
Chemung group. *Philipsburg, N. Y.*

HAMILTON & CHEMUNG GROUPS.

(AVICULIDÆ.)

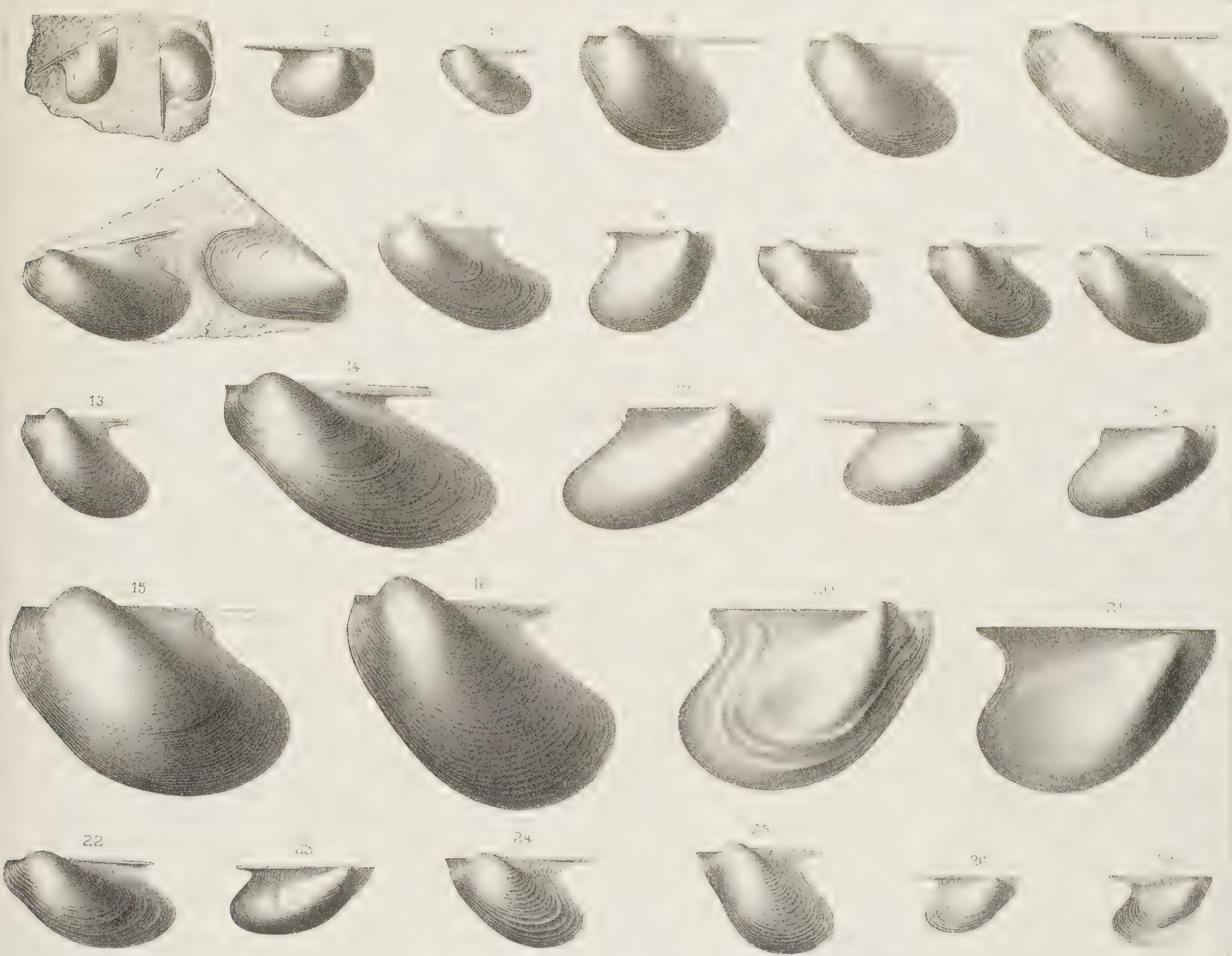

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PLATE XXII.

Leptodesma ? sp. indet.

Fig. 1. An obscure right valve of an indeterminate character.
Chemung group. *Ithaca, N. Y.*

Leptodesma complanatum.

Page 227.

Fig. 2. The left valve described. The striæ should turn backward along the hinge posterior to the beak.
Chemung group. *Philipsburg, Alleghany, Co., N. Y.*

Leptodesma Becki.

Page 185.

Fig. 3. A large right valve.
Chemung group. *Corning, Chemung Co., N. Y.*
Fig. 4. A smaller imperfect example.
Chemung group. *Near Portville, Cattaraugus Co., N. Y.*
Fig. 5. A small left valve showing the form and proportions of the shell.
Chemung group. *Corning, N. Y.*

Leiopteria Torreyi.

Page 174.

See Plate 88.

Figs. 6, 7. Two left valves, fig. 7, showing the characters of the species.
Chemung group. Fig. 6, from *Panama;* fig. 7, from *Salamanca, N. Y.*

Leptodesma Matheri.

Page 193.

See Plate 89.

Fig. 8. An imperfect left valve of medium size.
Fig. 9. A right valve.
Fig. 10. A small left valve. The body of the valve is represented as too broad.
Chemung group. *Bradford, McKean Co., Pa.*

Leptodesma potens.

Page 188.

See Plates 21 and 89.

Fig. 11. A right valve.
Chemung group. *Napoli, Cattaraugus Co., N. Y.*
Fig. 12. A similar left valve. The extremity of the wing should be represented as acute as in fig. 19.
Chemung group. *Near Olean, N. Y.*
Fig. 19. A large left valve.
Chemung group. *Portville, Cattaraugus Co., N. Y.*
Fig. 20. A more elongate form referred to this species with some doubt.
Chemung group. *Randolph, Cattaraugus Co., N. Y.*
Fig. 21. A large elongate left valve.
Chemung group. *Near Cassadaga, Chautauqua Co., N. Y.*

Leptodesma umbonatum.

Page 198.

See Plate 90.

Fig. 13. The left valve described. Another figure of this specimen is given on plate 90, fig. 9.
Chemung group. *Twenty Mile creek, Chautauqua Co., N. Y.*

LEPTODESMA UMBONATUM, var. DEPRESSUM.

Page 199.

See Plate 90.

Fig. 14. The specimen described. Another figure of this specimen is given on plate 90, fig. 10.
Chemung group. *Napoli, Cattaraugus Co., N. Y.*

LEPTODESMA NAVIFORME.

Page 200.

See Plate 23.

Fig. 15. The left valve described. The anterior end should be represented as more extended and acute, and the extremity of the wing as mucronate.
Chemung group. *Near Ithaca, N. Y.*

LEPTODESMA POTENS, var. JUVENS.

Page 189.

Fig. 16. A left valve.
Chemung group. *East Randolph, Cattaraugus Co., N. Y.*

LEIOPTERIA CHEMUNGENSIS.

Page 172.

Figs. 17, 18. Opposite views of the original specimen showing the left and right valves. The right valve is imbedded vertically in the rock and has been much shortened by the shrinkage or compression of the layers, while the surface of the shell has been slightly wrinkled from the same cause.
Chemung group. *Eight miles north of Binghamton, N. Y.*

LEPTODESMA LYSANDER.

Page 216.

See Plate 90.

Fig. 22. A left valve. The figure is partially restored and should represent the body as considerably wider.
Chemung group. *Mansfield, Tioga Co., Pa.*

LEPTODESMA EXTENUATUM.

Page 207.

See Plate 90.

Fig. 23. An imperfect left valve. Another figure of this specimen is given on plate 90, fig. 17.
Chemung group. *Philipsburg, Alleghany Co., N. Y.*

PTERONITES ROSTRATUS.

Page 238.

Fig. 24. The left valve described.
Chemung group. *Rockville, N. Y.*

PTERONITES PROFUNDUS.

Page 237.

Fig 25. A small left valve.
Chemung group. *New Albion, Cattaraugus Co., N. Y.*

Fig. 26. A larger example. The anterior side should show regular concentric undulations.
Chemung group. *Randolph, Cattaraugus Co., N. Y.*

Fig. 27. A large individual, imperfect on the anterior end.
Chemung group. *Near Olean, N. Y.*

LEPTODESMA ALIFORME.

Page 220.

See Plate 91.

Fig. 28. A right valve. This specimen is redrawn on plate 91, fig. 2, and represents more clearly the specific characters.
Chemung group. *Near Angelica, Alleghany Co., N. Y.*

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CHEMUNG GROUP.

(AVICULIDÆ.)

Plate XXII.

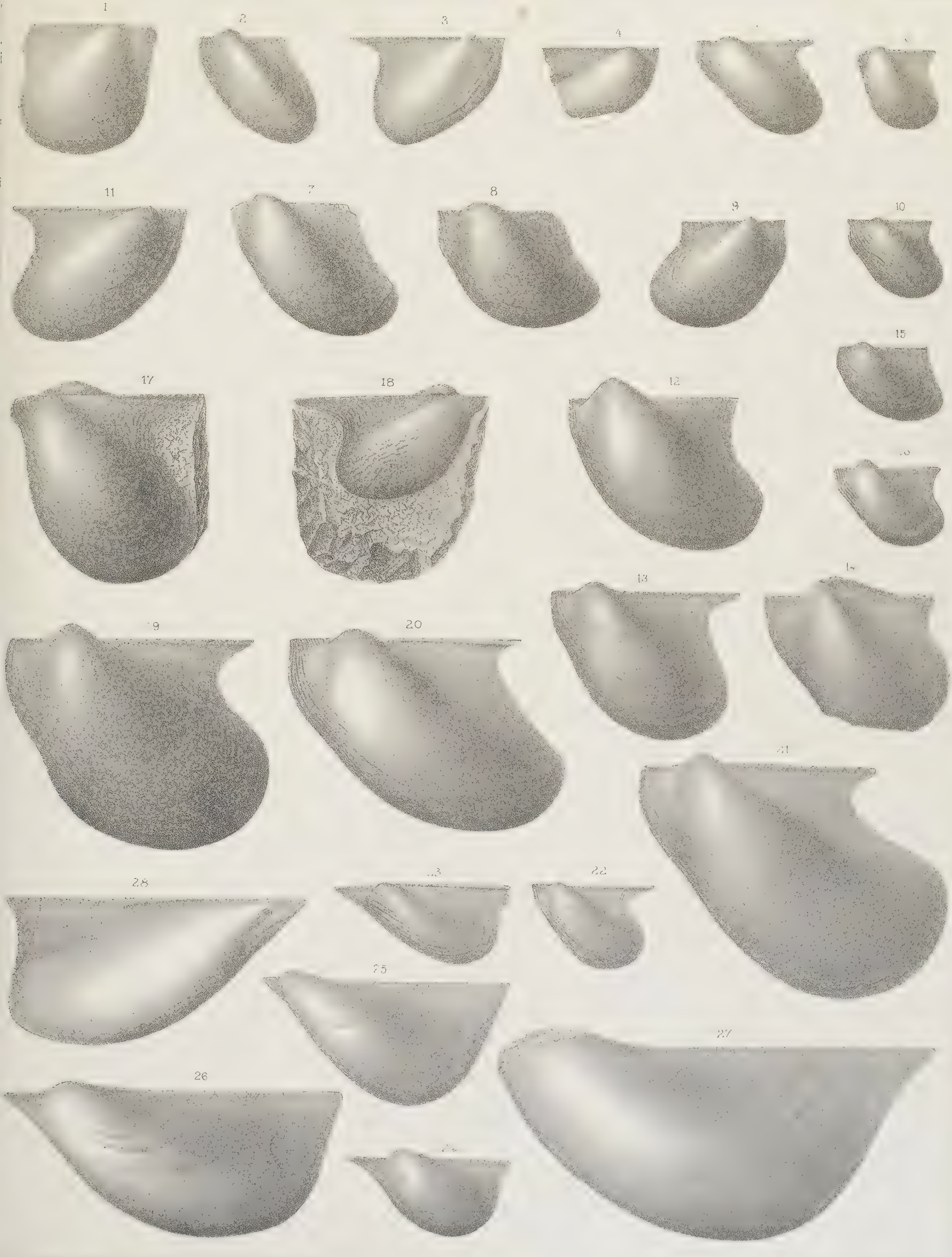

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PLATE XXIII.

LEPTODESMA NAVIFORME.

Page 200.

See Plate 22.

Fig. 1. A right valve showing the characters of the shell.
Chemung group. *Near Ithaca, N. Y.*

ACTINOPTERIA PERSTRIALIS.

Page 118.

See Plate 84.

Fig. 2. A left valve.
Fig. 7. A right valve of a larger example.
Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA DELTA.

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Fig. 3. The left valve described.
Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA EPSILON.

Page 122.

Fig. 4. A small left valve.
Figs. 5, 6. Two left valves referred to this species with some doubt on account of their finer surface radii.
Fig. 8. An impression of a left valve, retaining that of the right valve beneath it in the centre, thus showing partly the features of both.
Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA ZETA.

Page 123.

See Plate 84.

Fig. 9. A right valve showing the form and surface ornamentation, with two oblique lateral teeth.
Chemung group. *Ithaca, N. Y.*

PTYCHOPTERIA EXPANSA.

Page 152.

Fig. 10. The left valve described showing the form and surface ornamentation. The body is represented as too narrow and there should be a slight furrow limiting the wing.
Fig. 11. An enlargement of the surface from the anterior umbonal slope, showing the direction of the radii.
Chemung group. *Smethport, Pa.*

PTYCHOPTERIA PROTO.

Page 129.

Figs. 12, 14. Two left valves. The wings in each one should be limited by a slight furrow.
Chemung group. *Near Smethport, Pa.*

PTYCHOPTERIA SINUOSA.

Page 130.

See Plate 85.

Fig. 13. A left valve showing the form and surface characters. The wing should be limited by a shallow furrow.

Chemung group. *Near Smethport, Pa.*

LEPTODESMA MENTOR.

Page 205.

See Plate 90.

Fig. 15. An imperfect right valve supposed to belong to this species from its association.

Chemung group. *Near Smethport, Pa.*

PTYCHOPTERIA SAO.

Page 132.

See Plate 85.

Fig. 16. A left valve of medium size. The fold and furrow of the wing should be represented as stronger.

Fig. 23. An associated right valve.

Chemung group. *Panama, Chautauqua Co., N. Y.*

PTYCHOPTERIA SALAMANCA.

Page 131.

Figs. 17, 18. Two left valves showing the form of the shell and surface characters. Fig. 18 should show an alar fold similar to fig. 17.

Fig. 19. A cardinal view of the specimen, fig. 18, showing the relative convexity of the valves and the comparative elevation of the beaks.

Fig. 20. The right side of a specimen preserving both valves partly opened.

Chemung group. *Near Salamanca, N. Y.*

PTYCHOPTERIA ALATA.

Page 139.

See Plate 85.

Figs. 21, 22. Two small right valves.

Figs. 25, 26. Two larger characteristic right valves.

Chemung group. *Salamanca, N. Y.*

PTYCHOPTERIA EUCRATE.

Page 133.

See Plate 85.

Fig. 24. The right side of a specimen preserving both valves.

Chemung group. *Panama, N. Y.*

ECTENODESMA BIROSTRATUM.

Page 242.

See Plate 84.

Fig. 27. A right valve referred to this species, showing the form, surface ornamentation and strong, oblique lateral tooth.

Chemung group. *Four miles north of Chenango Forks, N. Y.*

Figs. 28–30. Three left valves in different degrees of preservation, showing some variation in form and surface markings.

Chemung group. *Franklin, Delaware Co., N. Y.*

CHEMUNG GROUP.

(AVICULIDÆ.)

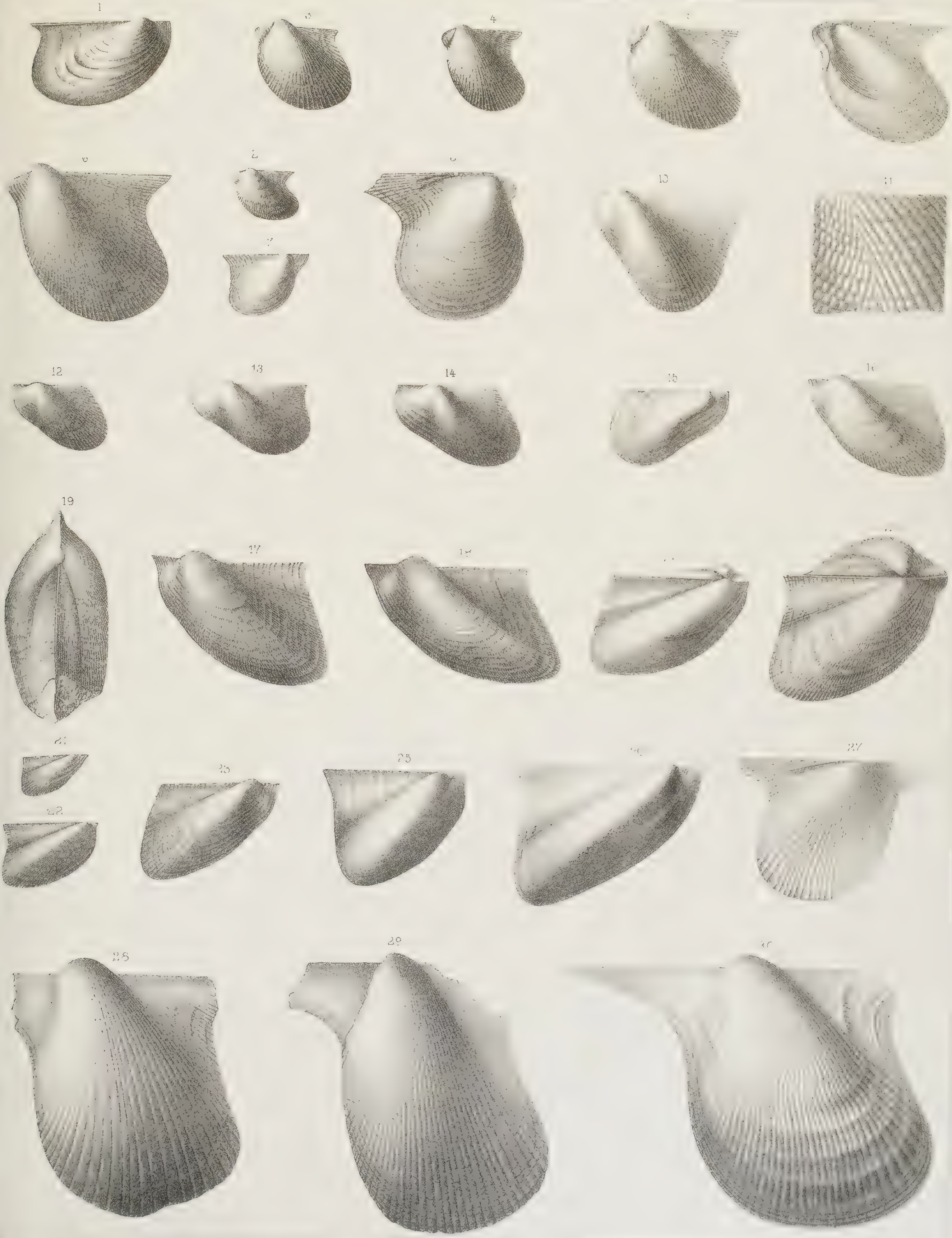

PLATE XXIV.

PTERINOPECTEN IMBECILIS.

Page 75.

Fig. 1. An imperfect left valve, × 2.

Chemung group. *Tioga, Tioga Co., Pa.*

PTERINOPECTEN (AVICULOPECTEN) STRICTUS.

Page 74.

See Plate 82.

Fig. 2. A right valve showing the form of the shell and the characters of the hinge.

Chemung group. *Near Elmira, N. Y.*

AVICULOPECTEN PLENUS.

Page 21.

Fig. 3. A left valve, showing the general features of the shell.

Chemung group. *Near Elmira, N. Y.*

AVICULOPECTEN IDAS.

Page 13.

See Plate 3.

Fig. 4. A right valve.

Hamilton group. *Cayuga lake, N. Y.*

LYRIOPECTEN SOLOX.

Page 56.

Fig. 5. A right valve, imperfect anterior to the beak. The recent discovery of the impression of this valve substantiates the correctness of the restoration of the anterior ear in the figure.

Chemung group. *Panama, N. Y.*

PTERINEA (VERTUMNIA) REVERSA.

Page 104.

See Plate 84.

Fig. 6. A large right valve. Another figure of this specimen is given on plate 84, fig. 24, to show the obsolescence of the rays on the wing.
Chemung group. *Elmira, N. Y.*

Fig. 12. A specimen with the valves united along the hinge, showing the convex right valve and flat or concave left valve.
Chemung group. *Chemung river, Upper Narrows, N. Y.*

AVICULOPECTEN PRINCEPS.

Page 1.

See Plates 1, 5, 6 and 81.

Fig. 7. An enlargement, to two diameters, of the impression of the hinge, showing the striations of the ligamental area.
Hamilton group. *Cazenoria, N. Y.*

LYRIOPECTEN CYMBALON.

Page 47.

Fig. 8. A large, perfect left valve. The specimen shows a striated ligamental area.
Hamilton group. *From a boulder near Elmira, N. Y.*

PTERINEA (VERTUMNIA) AVIS.

Page 105.

Fig. 9. An imperfect right valve.
Chemung group. *Near Elmira, N. Y.*

Fig. 11. A large, convex right valve. The figure should be restored at the cardinal angles to correspond with fig. 13.
Chemung group. *Mansfield, Pa.*

Fig. 13. A nearly entire left valve. The byssal sinus should be a little deeper than is represented.
Chemung group. *Near Elmira, N. Y.*

PTERINOPECTEN SUBORBICULARIS.

Page 80.

See Plates 8 and 82.

Fig. 10. A view of a large and very perfect left valve. The radii increase by interstitial addition and not by bifurcation as is represented in the figure.
Chemung group. *Elm Valley, Alleghany Co., N. Y.*

LIMOPTERA MACROPTERA.

Page 246.

See Plates 26, 27, 28, 29 and 92.

Fig. 14. A small right valve showing the form and surface ornamentation.
Hamilton group. *Pratt's Falls, Onondaga Co., N. Y.*

ALLOCARDIUM ALTERNATUM, gen. et sp. nov.

Fig. 15. A view of the specimen enlarged to two diameters. The relations of this shell are not apparent. It has the aspect of a bivalve shell in the characters of the rays and the cardinal auriculation, and somewhat resembles HIPPAGUS and TRIGONILUNA. With the present material it cannot be satisfactorily arranged with any known genus of molluscs.
Hamilton group. *Cayuga lake, N. Y.*

HAMILTON & CHEMUNG GROUPS.

(PECTINIDÆ.)

alæontology N.Y. Vol.V

Plate XXIV

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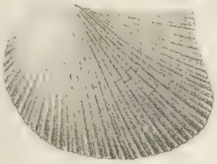

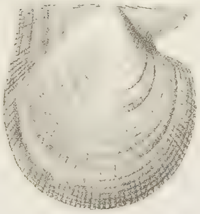

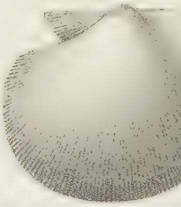

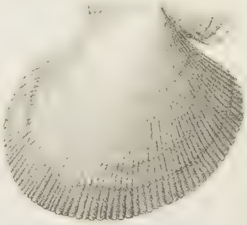

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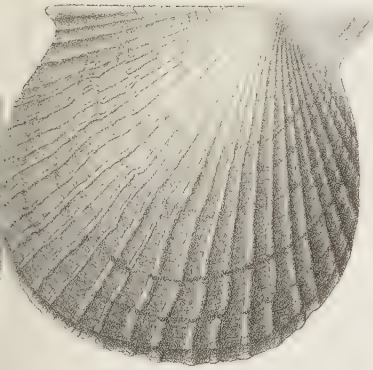

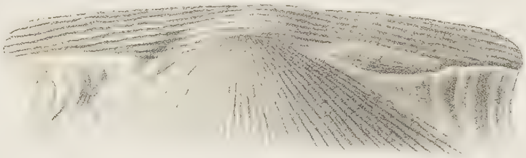

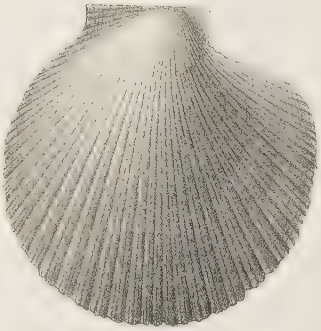

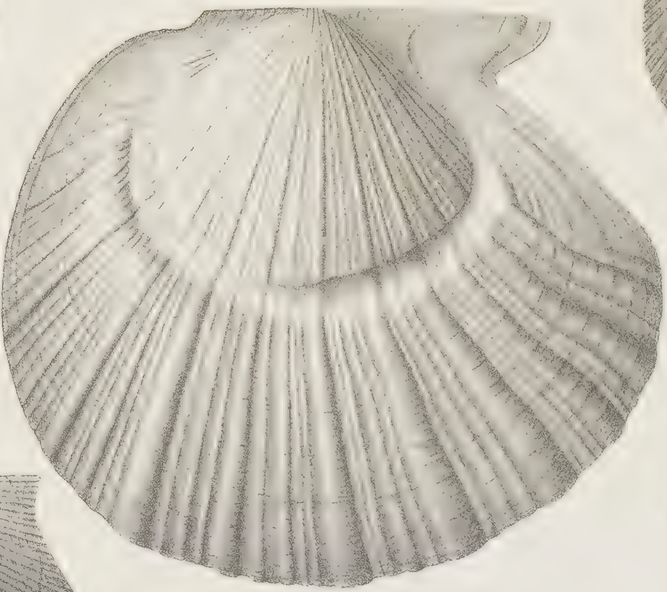

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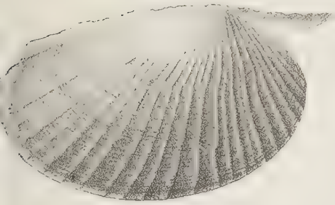

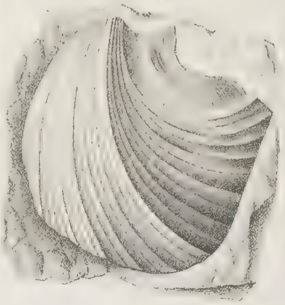

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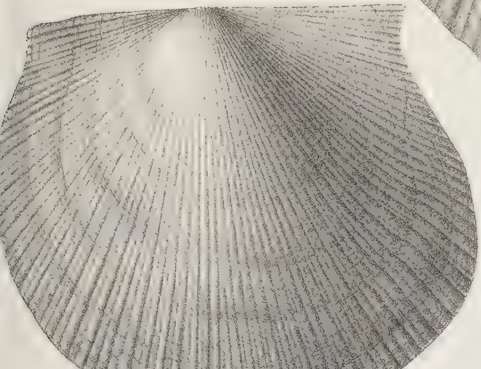

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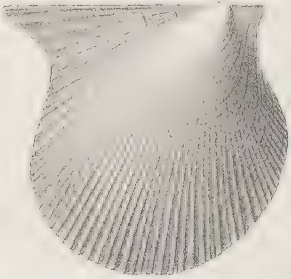

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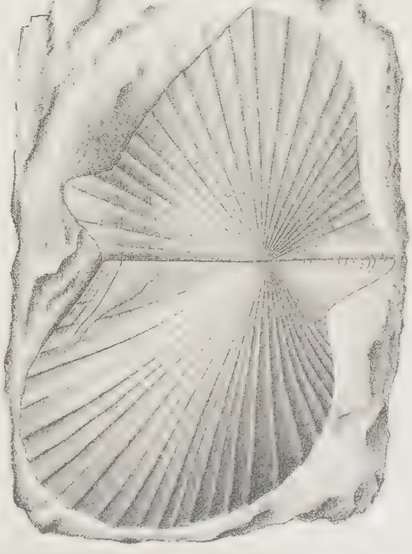

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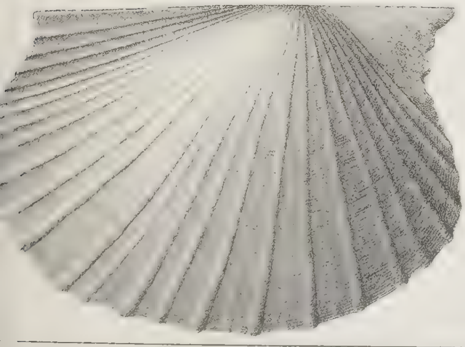

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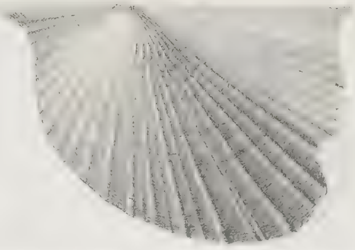

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PLATE XXV.

ACTINOPTERIA EXIMIA.

Page 107.

Fig. 1. A left valve somewhat imperfect on the wing but showing the form of the body and surface ornamentation.

Schoharie grit. *Schoharie, N. Y.*

LEPTODESMA DISPARILE.

Page 186.

See Plate 89.

Figs. 2, 3. Two right valves. The wing margin of fig. 2 should be sinuate to correspond with fig. 3.

Fig. 4. A left valve.

Chemung group. *McKean Co., Pa.*

LEPTODESMA CURVATUM.

Page 196.

Fig. 5. The left valve described.

Chemung group. *McKean Co., Pa.*

LEPTODESMA ORODES.

Page 206.

See Plate 90.

Figs. 6, 9. Two left valves. The specimen fig. 9, is redrawn on pl. 90, fig. 8.

Fig. 10. A large left valve somewhat distorted by pressure and referred to the species with doubt.
Chemung group. *Near Smethport, Pa.*

LEPTODESMA MYTILIFORME.

Page 235.

See Plate 91.

Figs. 7, 11. A right and left valve. Other illustrations of these specimens are given on plate 91, figs. 22 and 24, showing more clearly the specific characters.
Chemung group. *Near Smethport, Pa.*

LEPTODESMA MACLURII.

Page 228.

See Plate 91.

Fig. 8. A right valve. See fig. 14, pl. 91, for another figure of this specimen.

Fig. 13. A left valve. Another figure of the specimen is given on plate 91, fig. 13.
Chemung group. *Near Smethport, Pa.*

LEPTODESMA RUDE.

Page 221.

See Plate 91.

Fig. 12. The left valve described. See fig. 3, pl. 91.
Chemung group. *Near Smethport, Pa.*

GLYPTODESMA ERECTUM.

Page 153.

See Plates 11, 12, 13, 86 and 87.

Fig. 14. An internal mould of the upper portion of a left valve showing the lateral teeth and striated ligamental area. The large scar on the post-umbonal slope was probably made by the attachment of a *Crania* to the shell and covers a portion of the large muscular impression.
Hamilton group. *From a boulder near Nichols, N. Y.*

Fig. 15. An internal cast of a right valve, showing the pallial line and imprint of a strong posterior tooth.
Hamilton group. *Otsego Co., N. Y.*

Figs. 16, 17. A right and a left valve as preserved in a cherty limestone.
Hamilton group. *Indiana.*

PALÆOPINNA FLABELLA.

Page 240.

See Plate 87.

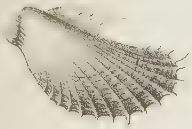
Fig. 18. The left valve described. See plate 87, fig. 4.
Oriskany sandstone. *Schoharie, N. Y.*

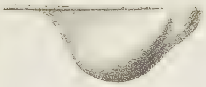
PALÆOPINNA RECURVA.

Page 241.

Fig. 19. A view of a large imperfect left valve.
Upper Helderberg group. *Stafford, Genesee Co., N. Y.*

(AVICULIDÆ.)





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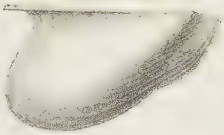

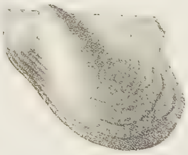

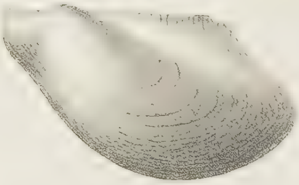

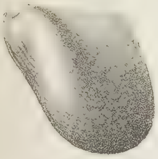

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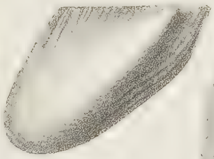

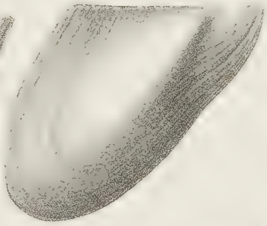

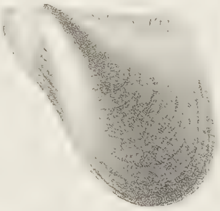

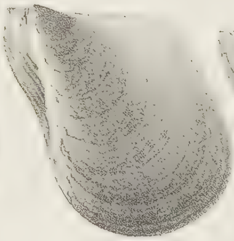

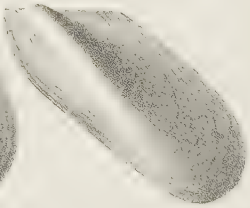

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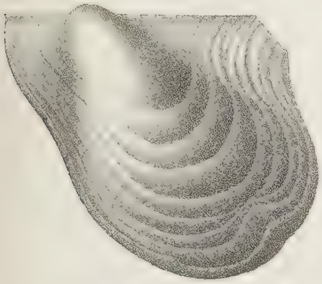

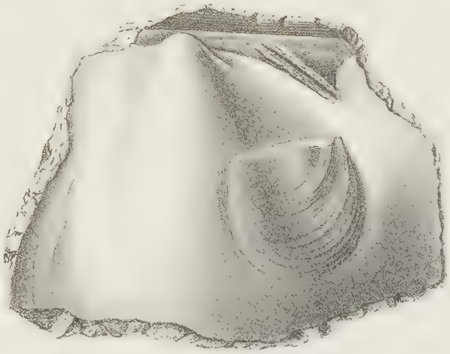

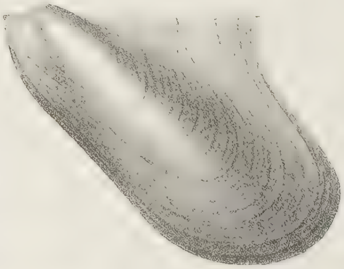

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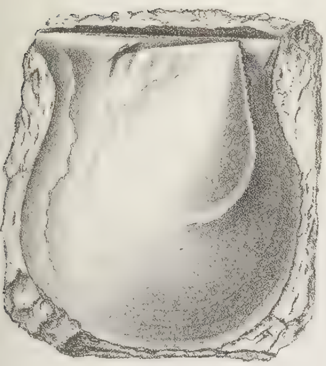

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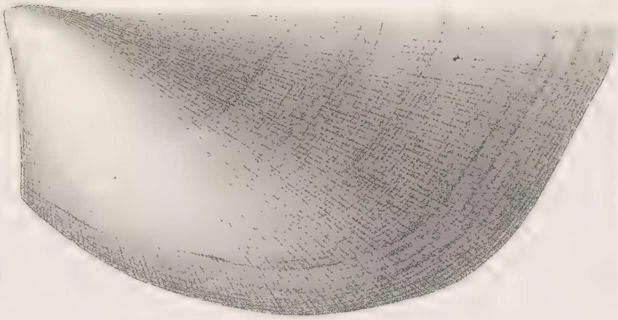

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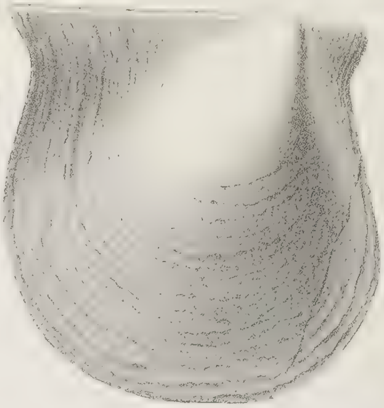

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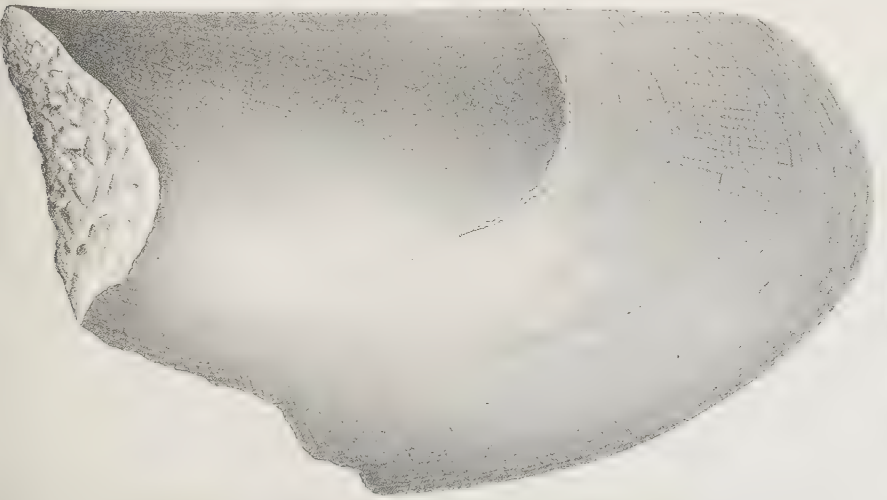

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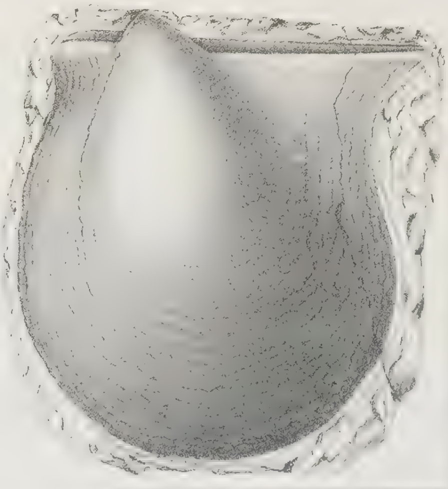

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PLATE XXVI.

LIMOPTERA CANCELLATA.

Page 244.

See Plate 92.

Fig. 1. The left valve of a specimen. Another figure of this valve is given on plate 92, fig. 3.

Fig. 2. The right side of the same. The pallial line and muscular impression are visible in each valve but are not represented in the figure.

Fig. 3. A cardinal view, showing at *a*, *a'*, the filling of the umbonal adductor muscular attachment where the pallial line terminates.

Fig. 4. An enlargement of the surface from the left valve.

Hamilton group. *Falls of the Ohio.*

LIMOPTERA PAUPERATA.

Page 243.

Fig. 5. View of an imperfect left valve. The radii on the wing and posterior side of the body are not made sufficiently distinct.

Upper Helderberg group. *Stafford, Genesee Co., N. Y.*

LIMOPTERA MACROPTERA.

Page 246.

See Plates 24, 27, 28, 29 and 92.

Figs. 6, 7. Two left valves showing the striations of the hinge area.

Hamilton group. *Madison Co., N. Y.*

Fig. 8. The profile of a small specimen which has been laterally compressed, giving more than the natural rotundity.

Hamilton group. *Cazenovia, N. Y.*

Fig. 9. A view of the left valve showing fewer and stronger radii than usual.

LIMOPTERA OBSOLETA?

Page 249.

See Plates 29 and 92.

Fig. 10. A view of the upper portion of the right side of a specimen, showing the broad striated ligamental area of the left valve.

Hamilton group. *Cazenovia, N. Y.*

UPPER HELDERBERG & HAMILTON GROUPS.

(AMBONYCHIIDÆ.)

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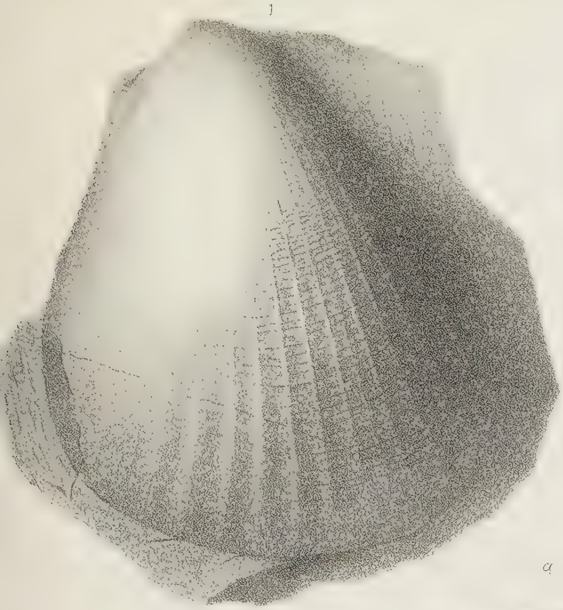

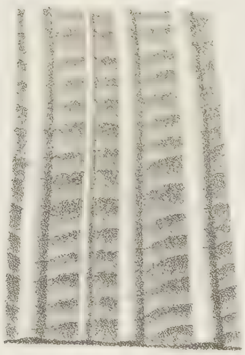

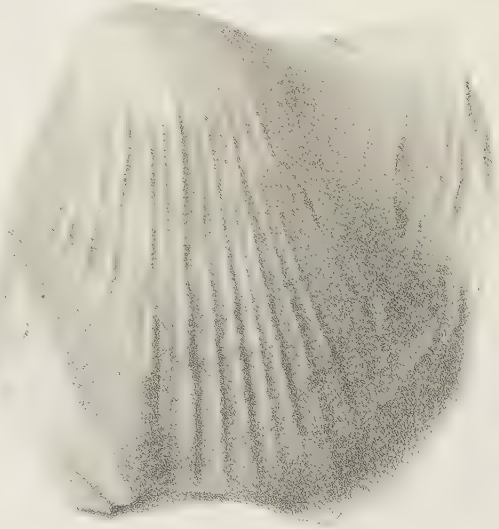

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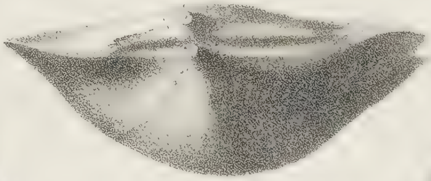

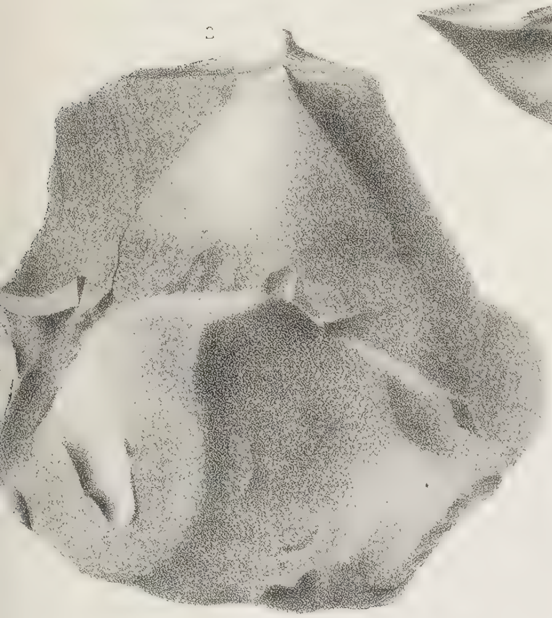

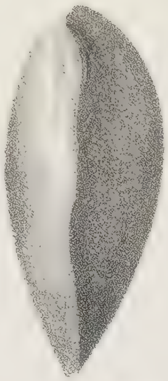

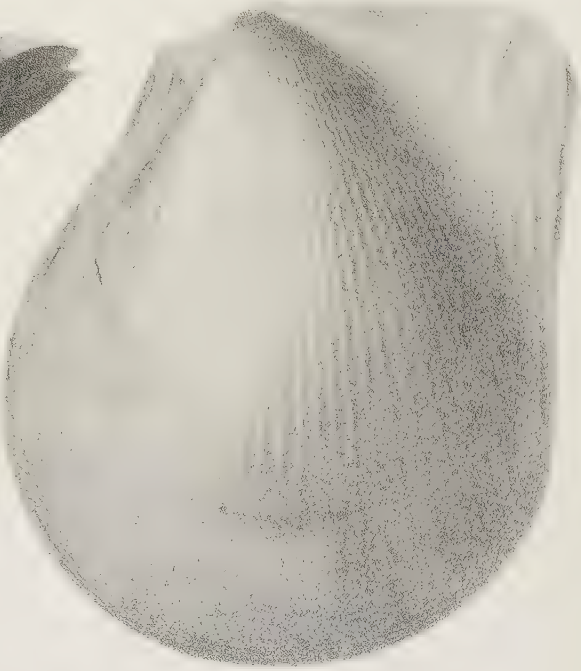

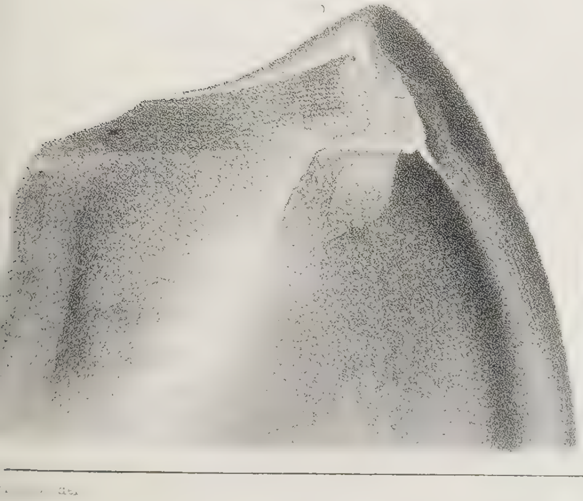

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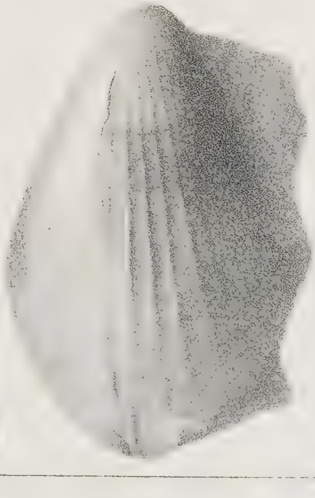

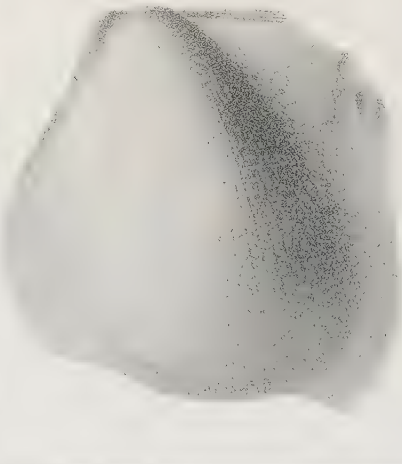

PLATE XXVII.

LIMOPTERA MACROPTERA.

Page 246.

See Plates 24, 26, 28, 29 and 92.

Fig. 1. The right valve of a small individual which is very perfect in form.

Fig. 2. A small right valve.

Hamilton group. *Summit, Schoharie Co., N. Y.*

Fig. 3. A somewhat larger example.

Hamilton group. *Lebanon, Madison Co., N. Y.*

Fig. 4. A left valve obliquely compressed and showing no surface radii.

Fig. 5. The right valve of the preceding.

Fig. 10. A profile view showing the comparative convexity of the valves. This specimen is the original of Conrad's description.

Hamilton group. *Madison Co., N. Y.*

Figs. 6, 7. Two views of a specimen which shows very distinctly the character of the surface.

Fig. 8. A cardinal view of a large specimen. The figure was intended to show the striated area of both valves and a vertical depression under the beaks as if from a receding cartilage pit; but these features have unfortunately been lost in the lithography.

Fig. 9. A cardinal view of an individual distorted by lateral compression. The internal mould shows one distinct point of muscular attachment on the apex of each valve. See plate 28, fig. 4, for an illustration of the right valve of this specimen showing the umbonal muscular impression and pallial line.

Hamilton group. *Madison Co., N. Y.*

HAMILTON GROUP.

(AMBONYCHIIDÆ.)

Palæontology N.Y. Vol V.

Plate. [illegible]

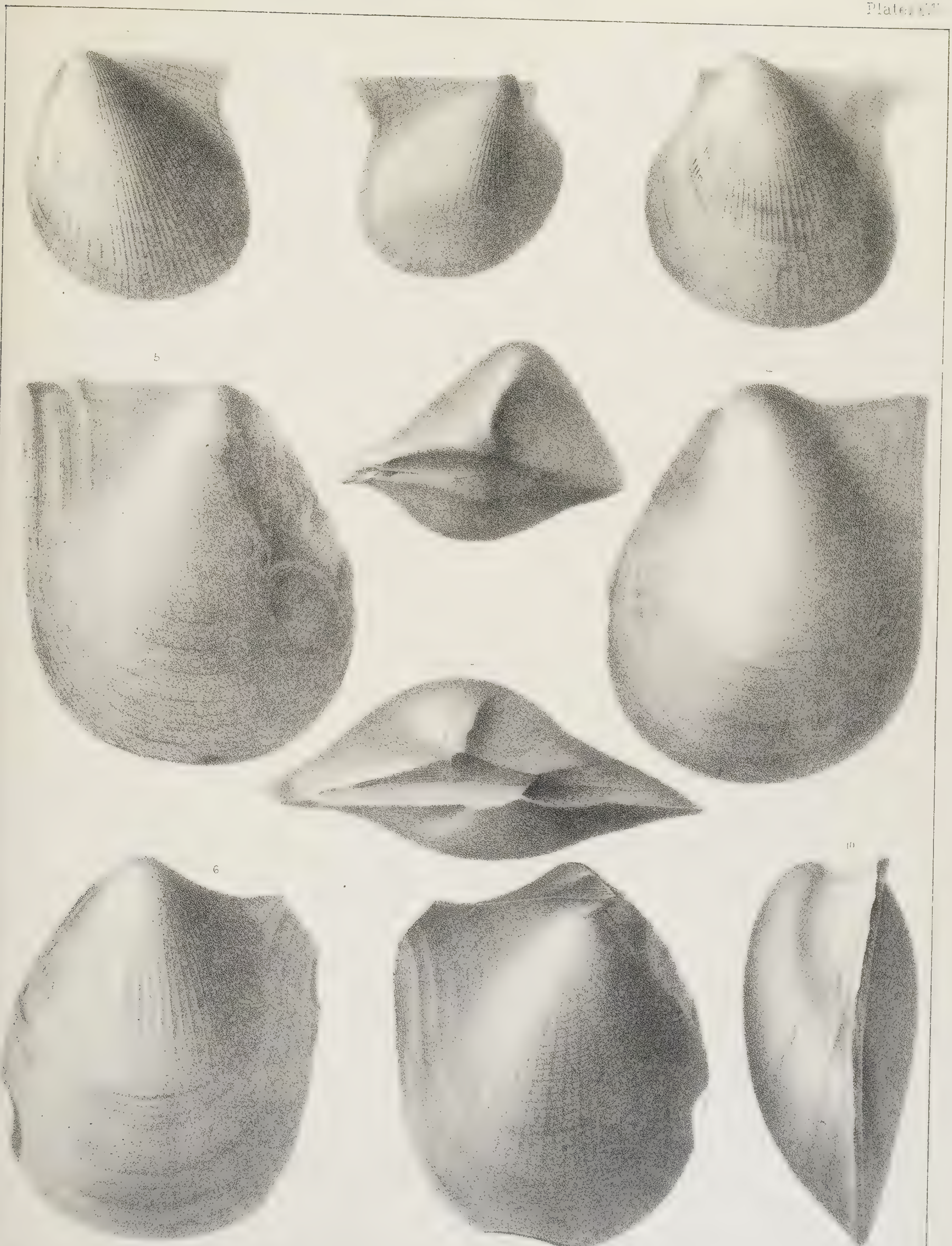

PLATE XXVIII.

LIMOPTERA CURVATA.

Page 250.

Fig. 1. A large left valve showing the anterior curvature of the beak and the alternation of the radii.

Fig. 2. An internal cast of a left valve showing the inter-pallial area covered with small pustules which were apparently the points of attachment for umbonal muscles. The specimen shows the pallial line and muscular impression.

Fig. 3. The left valve of a large specimen, showing the wing and some traces of the radii. The post-basal margin is not sufficiently extended in the figure.

Hamilton group. *Madison Co., N. Y.*

LIMOPTERA MACROPTERA.

Page 246.

See Plates 24, 26, 27, 29 and 92.

Fig. 4. The right side of a laterally compressed specimen, represented on pl. 27, fig. 9, and pl. 29, fig. 2. The umbonal scar is here shown in its true position.

Fig. 5. The left side of an unusually elongate specimen, due in part to the breaking away of the margin of the left valve to the margin of the right valve.

Hamilton group. *Madison Co., N. Y.*

HAMILTON GROUP.

(AMBONYCHIIDÆ.)

Plate XXVIII.

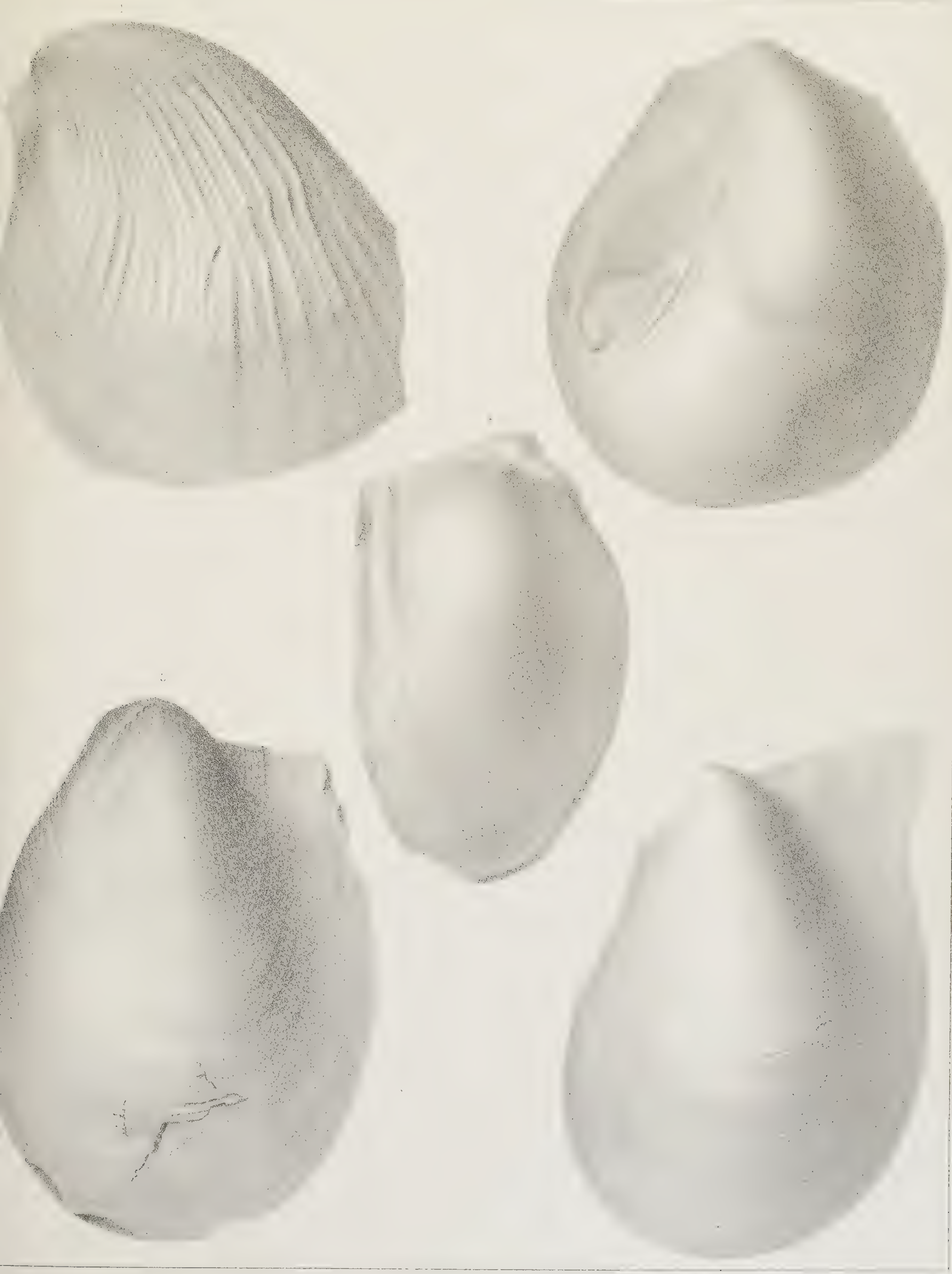

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PLATE XXIX.

LIMOPTERA MACROPTERA.

Page 246.

See Plates 24, 26, 27, 28 and 92.

Fig. 1. The right side of the specimen fig. 8, plate 26.

Fig. 2. A view of the left side of the specimen fig. 9, pl. 27, and fig. 4, pl. 28.

Figs. 3, 4. The profile and left views of a much distorted specimen, showing the effects of compression.

Hamilton group. *Madison Co., N. Y.*

LIMOPTERA OBSOLETA.

Page 249.

See Plates 26 and 92.

Fig. 5. The left side of a specimen slightly imperfect on the anterior side, but showing the usual surface characters.

Hamilton group. *Hamilton, Madison Co., N. Y.*

Fig. 6. A left valve showing the surface characters and the striated ligamental area.

Hamilton group. *Cayuga lake, N. Y.*

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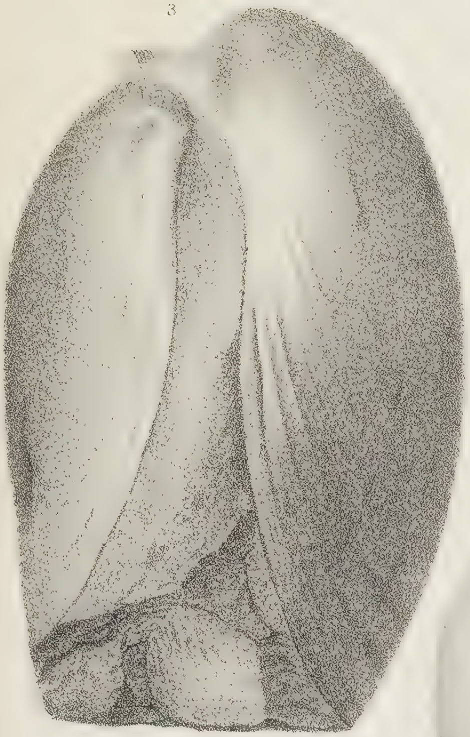

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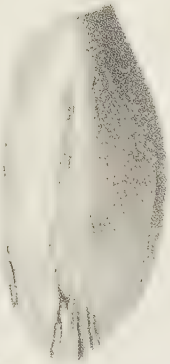

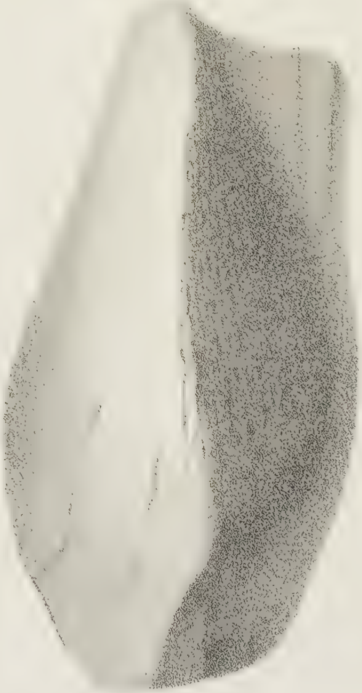

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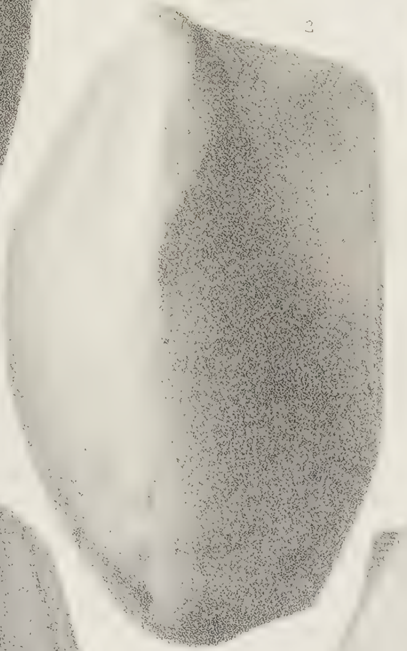

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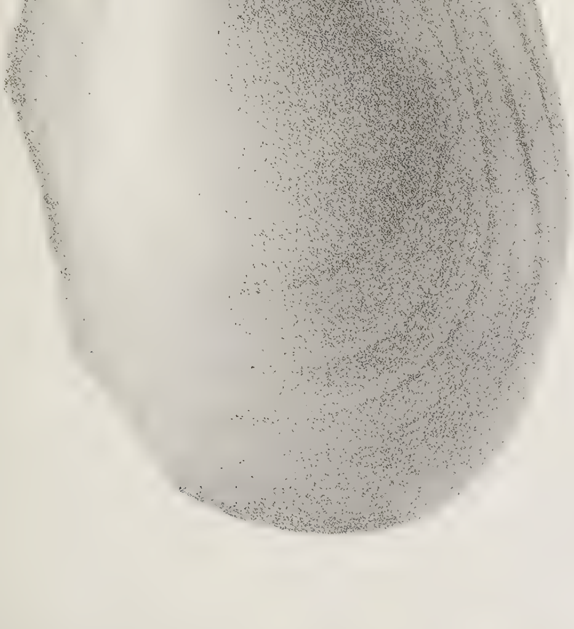

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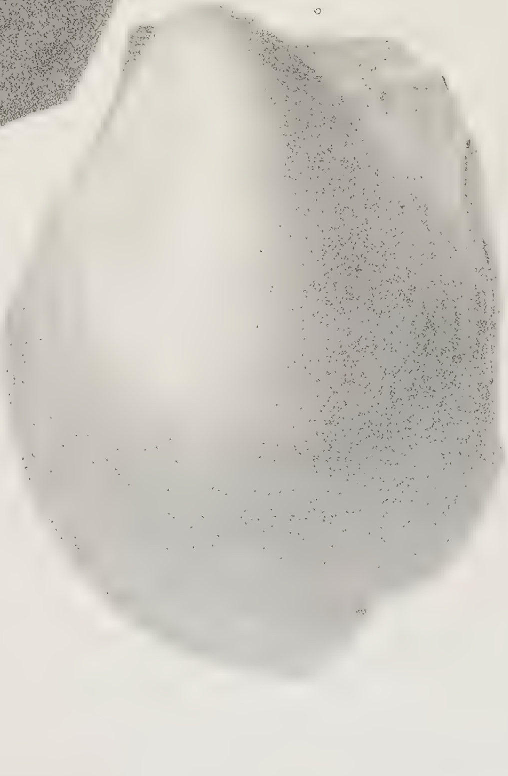

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PLATE XXX.

MYTILARCA (PLETHOMYTILUS) ARENOSA.

Page 253.

See Plate 87.

Fig. 1. A right valve of medium size.
Schoharie grit. *Schoharie, N. Y.*

MYTILARCA (PLETHOMYTILUS) PONDEROSA.

Page 254.

Fig. 2. A right valve of a small specimen.
Fig. 3. A left valve of a larger specimen, showing considerable extension of hinge-line.
Fig. 4. A left valve of medium size.
Upper Helderberg group. *Clarence Hollow, Erie Co., N. Y.*
Fig. 5. The under side of the rostral portion of a specimen showing the great breadth of the striated ligamental area. The margin of the shell is compressed and bent inwards on the anterior side showing the surface striæ.
Upper Helderberg group. *Columbus, Ohio.*
Figs. 6, 7. The profile and left views of a large specimen entirely denuded of the test.
Upper Helderberg group. *Columbus, Ohio.*

UPPER HELDERBERG GROUP.

(AMBONYCHIIDÆ.)

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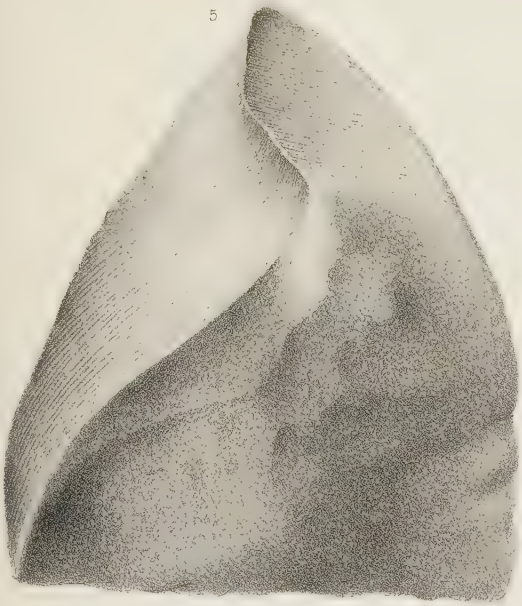

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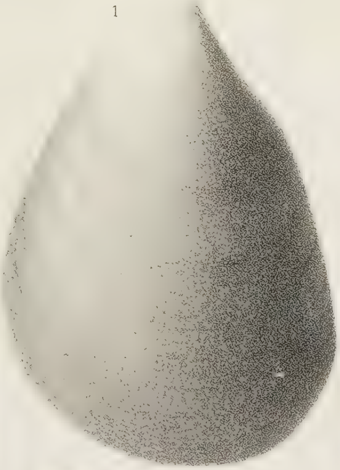

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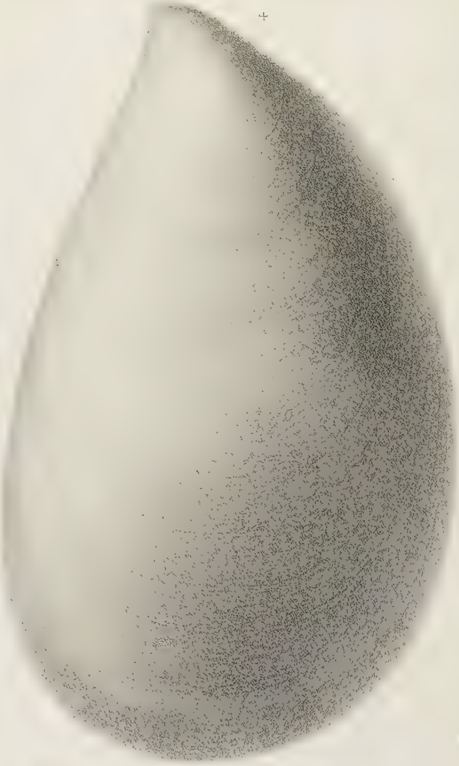

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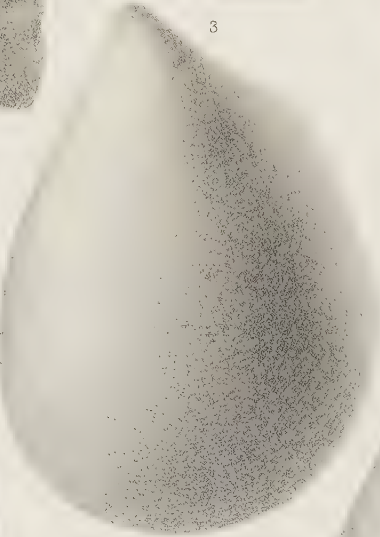

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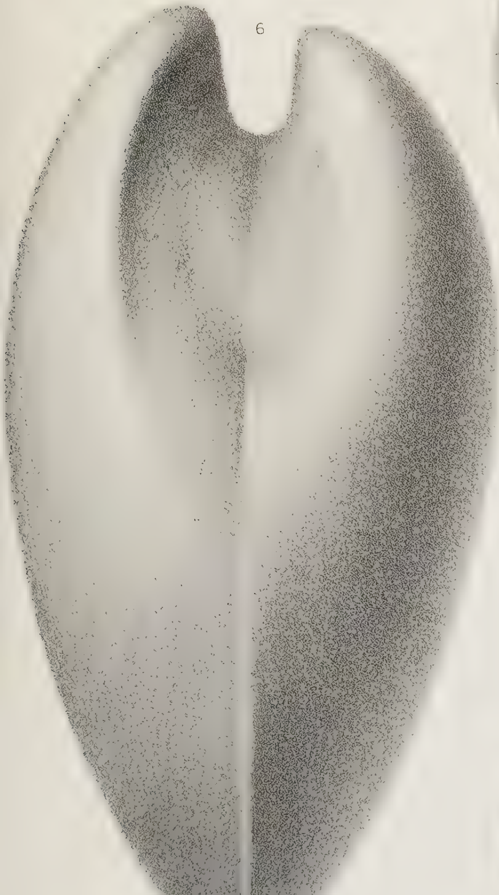

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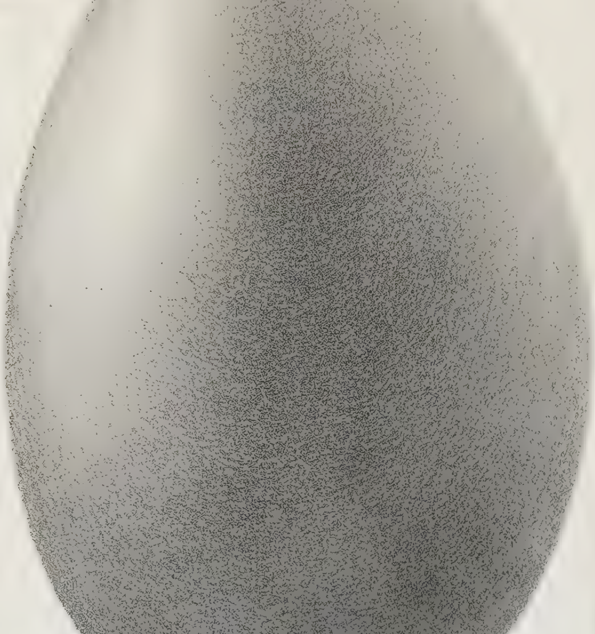

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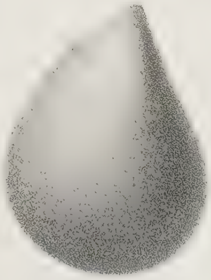

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PLATE XXXI.

MYTILARCA (PLETHOMYTILUS) OVIFORMIS.

Page 255.

See Plate 87.

Fig. 1. A left valve of a young shell of elongate form.
Hamilton group. *Cayuga lake, N. Y.*

Fig. 2. A left valve of the ordinary size, showing the striated hinge-area and three posterior teeth on the wing which are not sufficiently marked in the lithography.
Hamilton group. *Cayuga lake, N. Y.*

Fig. 3. A right valve showing the strong ligamental area.

Fig. 4. A more elongate form with attenuate beak.
Hamilton group. *York Centre, Livingston Co., N. Y.*

Fig. 5. The anterior side of a compressed specimen preserving the valves in contact at the hinge, but widely parted below.
Hamilton group. *Geneseo, Livingston Co., N. Y.*

Fig. 6. A large right valve widened below by compression.
Hamilton group. *Seneca lake, N. Y.*

Fig. 7. A cast of a small elongate right valve. The beak has been removed to show the ligamental area; the three oblique lateral teeth are seen on the post-cardinal angle.
Hamilton group. *Canandaigua lake, N. Y.*

Fig. 8. A large, broad right valve showing an unusually short hinge-area.
Hamilton group. *Bellona, Yates Co., N. Y.*

GOSSELETTIA TRIQUETRA.

Page 265.

See Plate 87.

Fig. 9. A view of the left valve of a young individual of this species.

Fig. 10. The right side of a very ventricose specimen preserving the natural form. Supposed to be the original specimen.

Figs. 11, 13, 14. The Left, cardinal and posterior views of a specimen preserving the natural convexity and showing the posterior teeth of the left valve.
Hamilton group. *Onondaga Co., N. Y.*

Fig. 12. The anterior side of a similar specimen showing the anterior muscular impressions.
Hamilton group. *Onondaga Co., N. Y.*

Fig. 15. A partial cast of a left valve. The beak has been removed to show the strong anterior teeth and anterior muscular impression.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 16. A large left valve preserving the surface markings and the ligamental area.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 17. A large right valve.
Hamilton group. *Madison Co., N. Y.*

HAMILTON GROUP.

(AMBONYCHIIDÆ)

Plate. XXXI

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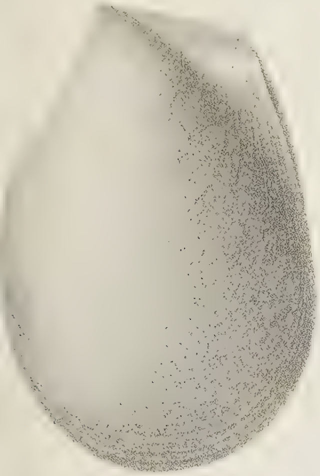

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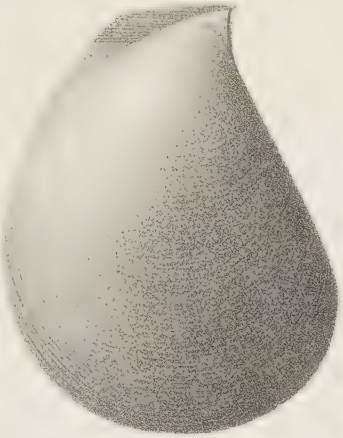

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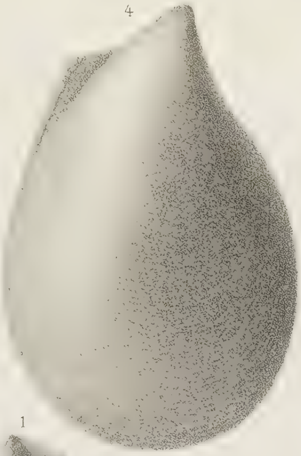

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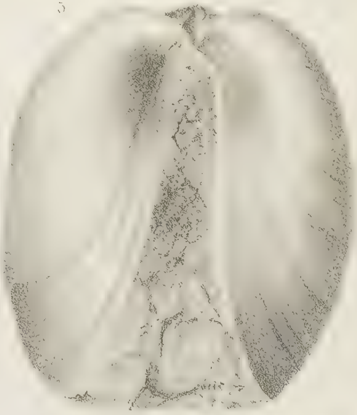

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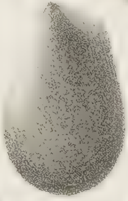

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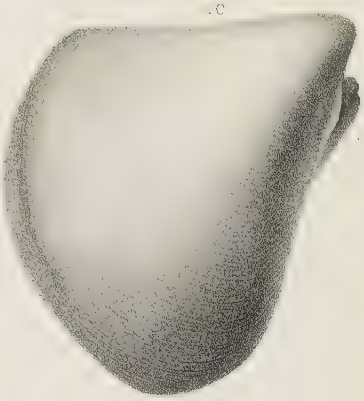

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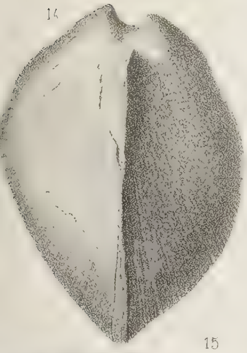

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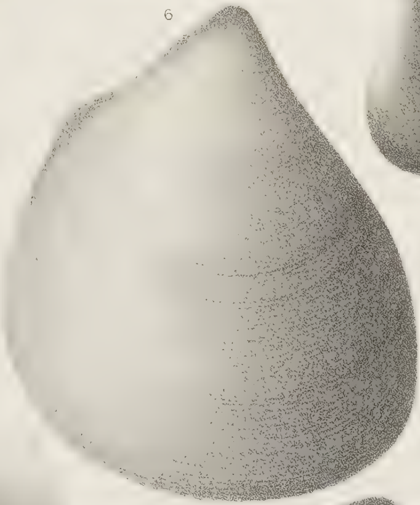

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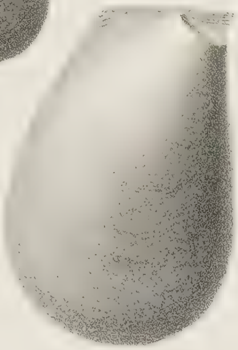

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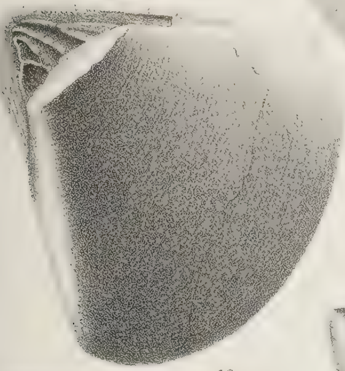

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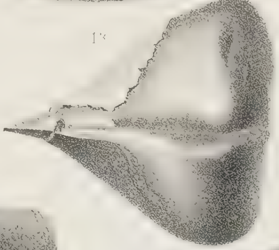

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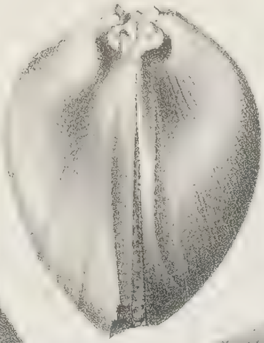

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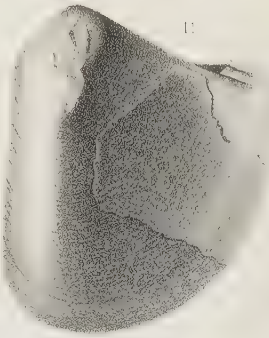

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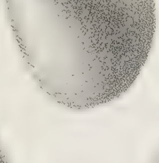

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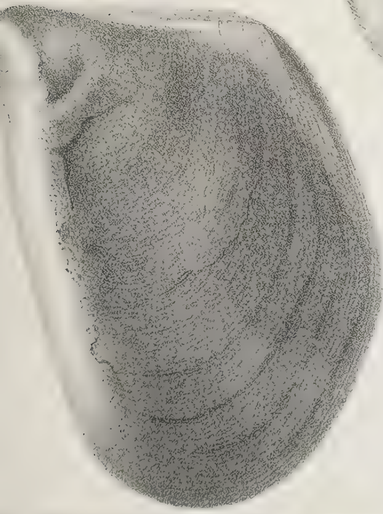

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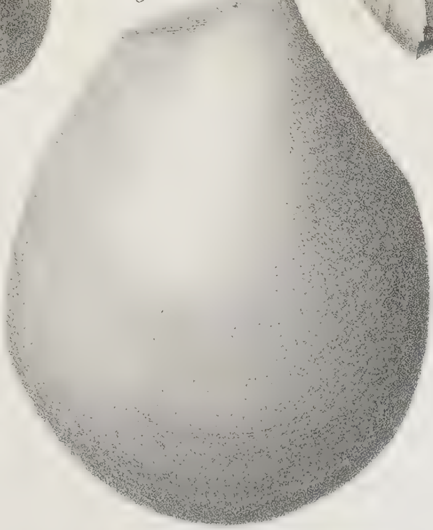

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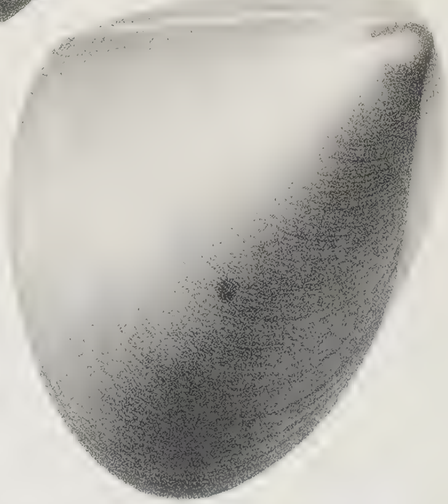

PLATE XXXII.

MYTILARCA UMBONATA.

Page 257.

Figs. 1-4. The right, left, anterior and posterior views of an individual preserving both valves. The specimen has been slightly compressed laterally, giving an unnatural sharpness to the rostral portions.

Chemung group. *Ithaca, N. Y.*

Figs. 5, 6, 7. The posterior, anterior and right sides of a specimen. Fig. 6 shows what appears to be the pallial line terminating near the beak.

Chemung group. *Mansfield, Pa.*

MYTILARCA CHEMUNGENSIS.

Page 258.

Fig. 8. A small right valve showing the striated ligamental area.

Chemung group. *Philipsburg, Alleghany Co., N. Y.*

Fig. 9. A left valve with the beak partially broken away showing the small cardinal teeth.

Chemung group. *Rockville, Alleghany Co., N. Y.*

Fig. 10. The interior of a left valve from an impression in the shale, showing the striated hinge-area.

Chemung group. *Rockville, N. Y.*

Fig. 11. A small. broad right valve.

Fig. 13. An impression of the margin of a large left valve, showing the form of the hinge and its breadth as extending within the margin of the shell.

Chemung group. *Rockville, N. Y.*

Fig. 14. A very narrow and erect left valve showing also the striations of the hinge.

Chemung group. *East Randolph, N. Y.*

MYTILARCA REGULARIS.

Page 260.

Fig. 12. A left valve showing the broad rounded form and straight erect beak.

Chemung group. *Leon Centre, Cattaraugus Co., N. Y.*

MYTILARCA CARINATA.

Page 259.

See Plate 33.

Fig. 15. A small left valve.

Chemung group. *Near Elmira, N. Y.*

Fig. 16. A small right valve showing the form of the shell.

Chemung group. *Factoryville, Tioga Co., N. Y.*

Figs. 17, 18. Two opposite valves showing some variation in the form of the shell.

Chemung group. *Near Elmira, N. Y.*

Fig. 19. An internal cast preserving impressions of the cardinal and lateral teeth and showing the striated ligamental area.

Chemung group. *Near Elmira, N. Y.*

MYTILARCA ATTENUATA.

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Fig. 20. A left valve showing the erect subcarinate form and attenuate beak.

Chemung group. *Elmira, N. Y.*

BYSSOPTERIA RADIATA.

Page 252.

See Plate 80.

Fig. 21. A right valve imperfect at the beak, but showing the surface characters and angular anterior side.

Fig. 22. An imperfect left valve which shows the general outline. The radii are not so distinctly duplicate as on the other specimen.

Chemung group. *Mansfield, Tioga Co., Pa.*

CHEMUNG GROUP.

(AMBONYCHIIDÆ.)

Plate XXXII.

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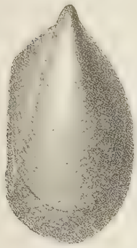

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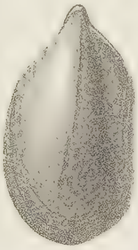

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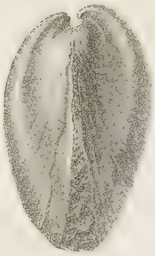

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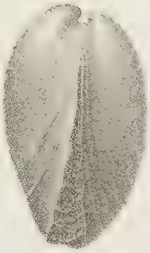

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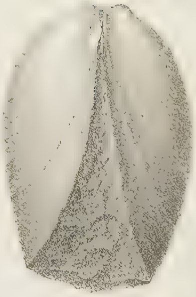

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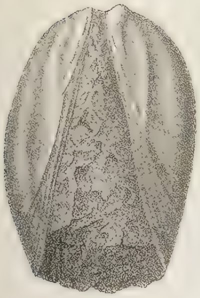

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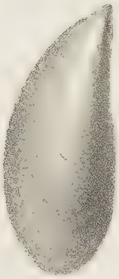

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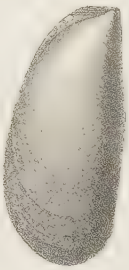

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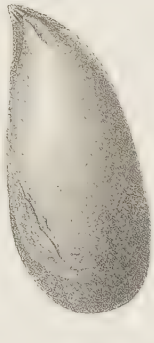

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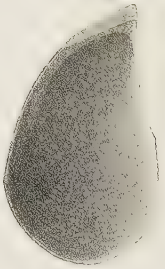

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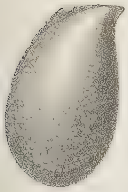

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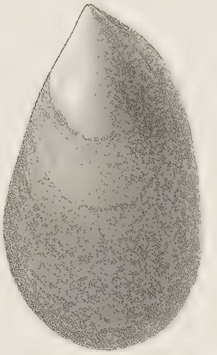

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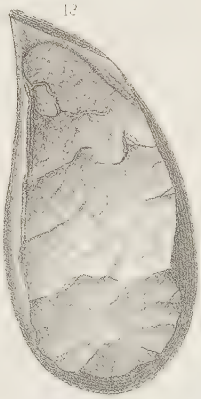

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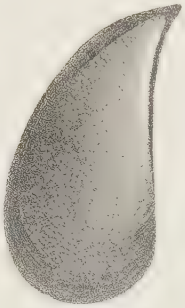

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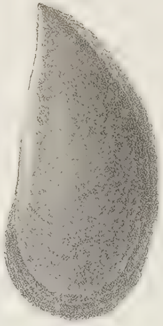

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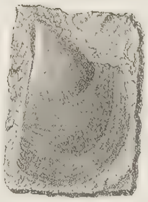

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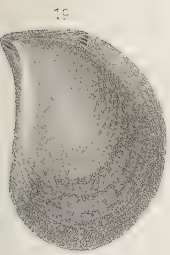

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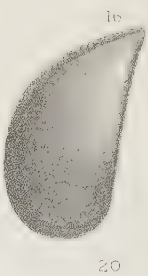

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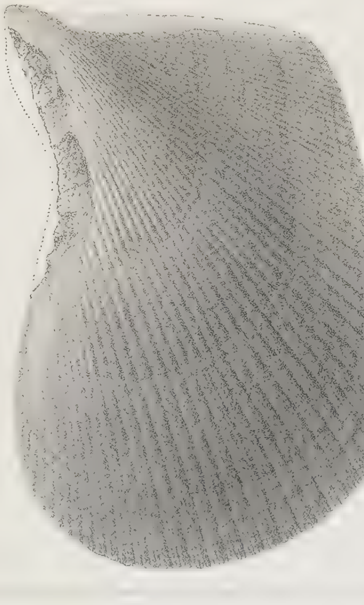

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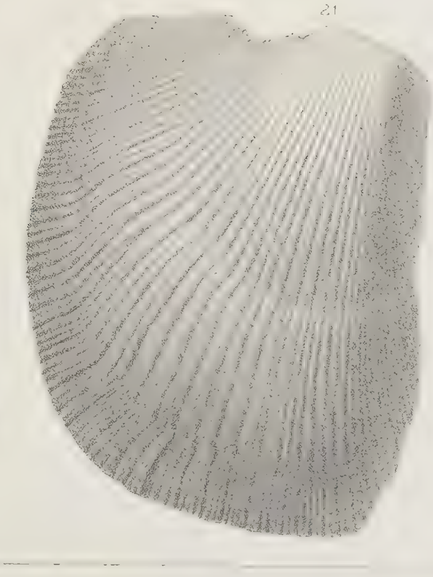

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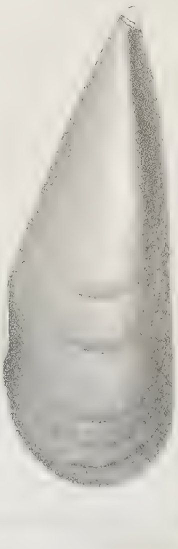

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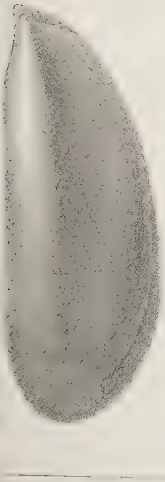

PLATE XXXIII.

GOSSELETTIA RETUSA.

Page 266.

Fig. 1. The left side of a well-preserved specimen, showing the general form of the shell.
Hamilton group. *Eighteen Mile creek, Erie Co., N. Y.*
Fig. 2. The antero-cardinal view of the same.

MYTILARCA OCCIDENTALIS.

Page 263.

See Plate 87.

Fig. 3. A view of the right side of the original of this species.
Fig. 4. The anterior view of the same.
Fig. 5. A left valve. The ante-byssal portion is represented as too large. See fig. 11, plate 87.
Yellow sandstone. *Burlington, Iowa.*

MYTILARCA FIBRISTRIATA.

Page 264.

See Plate 87.

Fig. 6. A left valve. Another figure of this specimen is given on plate 87, fig. 6, to show the form of the anterior end and the presence of radii.
Fig. 7. The right side of the original specimen as seen in a sulphur cast.
Yellow sandstones. *Burlington, Iowa.*

MYTILARCA CARINATA.

Page 259.

See Plate 32.

Fig. 8. An enlargement of the cardinal portion of fig. 19, plate 32, as obtained from an impression, showing more clearly the hinge characters.

Chemung group. *Near Elmira, N. Y.*

MODIOLA (MYTILOPS) PRÆCEDENS.

Page 267.

Fig. 9. A small left valve denuded of the striæ.

Figs. 10, 11. Cardinal views of two specimens with the valves partly opened.

Fig. 12. A small right valve.

Fig. 13. A left valve of medium size, preserving the surface striæ.

Fig. 14. An elongate right valve, showing the surface characters.

Chemung group. *Olean, N. Y.*

Fig. 15. A right valve, probably of this species but showing no surface striæ.

Chemung group. *Smethport, Pa.*

Fig. 16. The cardinal view of a specimen, with both valves strongly striate.

Fig. 17. A large broad specimen preserving the surface markings.

Fig. 18. The anterior view of an example showing nearly equal convexity of both valves.

Chemung group. *Olean, N. Y.*

MYTILARCA SIMPLEX.

Page 261.

Fig. 19. A large right valve, showing varices of growth.

Fig. 21. A smaller left valve. The beak should be directed slightly to the left to give the proper expression to the figure.

Chemung group. *Smethport, Pa.*

MYTILARCA GIBBOSA.

Page 262.

See Plate 87.

Fig. 20. The left valve described. Another figure is given on plate 87, fig. 7.

Chemung group. *Napoli, Cattaraugus Co., N. Y.*

MYTILARCA LATA.

Page 262.

Fig. 22. A right valve showing the broad form of the shell.

Chemung group. *Randolph, N. Y.*

MODIOLA (MYTILOPS) METELLA.

Page 268.

See Plate 87.

Figs. 23, 24. Two right valves showing the general form of the shell. A figure of another specimen is given on plate 87 in the same position as the figures of *M. præcedens* on the present plate for a better comparison.

Chemung group. *Chautauqua Co., N. Y.*

HAMILTON & CHEMUNG GROUPS, etc.

(AMBONYCHIIDÆ & MYTILIDÆ.)

Palæontology N.Y. Vol.V.

Plate XXXIII

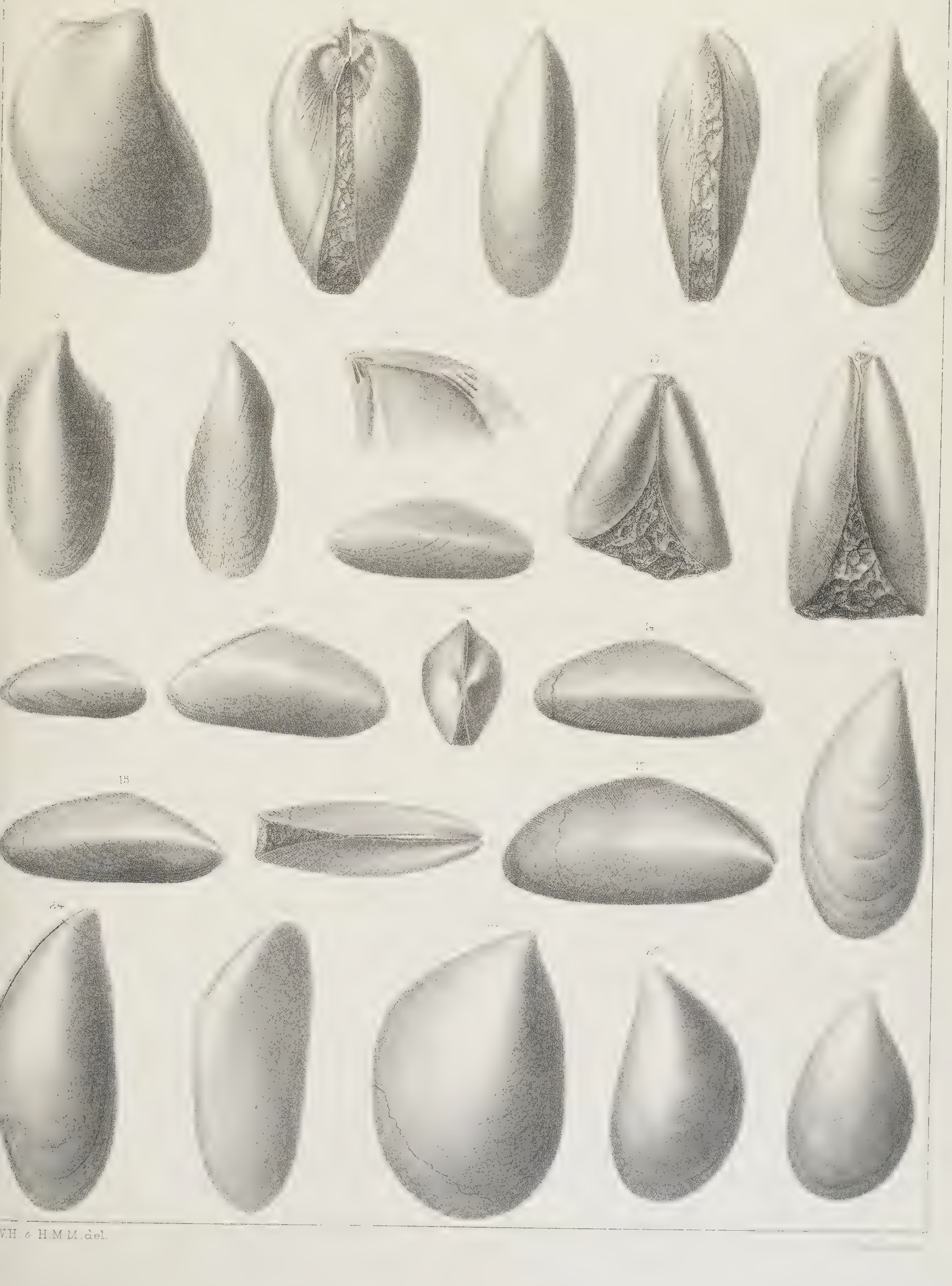

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PLATE LXXXI.

AVICULOPECTEN FASCICULATUS.

Page 11.

See Plate 5.

Fig. 1. A left valve showing the characteristic fasciculate radii.
Hamilton group. *Near Clarksville, Albany Co., N. Y.*

Fig. 2. A left valve with finer and more regular radii.
Hamilton group. *Near Clarksville, N. Y.*

Fig. 3. The specimen pl. 5, fig. 11, redrawn to show the concentric striæ.
Hamilton group. *Castleton, Ontario Co., N. Y.*

Fig. 4. A right valve preserving the radii on the ears and showing the subdued characters of the surface as compared with the left valve.
Hamilton group. *Near Clarksville, N. Y.*

AVICULOPECTEN LAUTUS.

Page 14.

See Plate 3.

Fig. 5. A figure made from an impression in gutta-percha, from the interior of the specimen illustrated on pl. 3, fig. 17, showing more clearly the surface ornamentation.
Hamilton group. *York Centre, Livingston Co., N. Y.*

AVICULOPECTEN TENUIS.

Page 39.

See Plate 7.

Fig. 6. The left valve represented on pl. 7, fig. 28, redrawn to show the true form and ornamentation, with the pallial line and muscular impression.
Chemung group. *Near Salamanca, N. Y.*

AVICULOPECTEN INSIGNIS.

Page 34.

See Plates 1 and 3.

Fig. 7. A left valve preserving the form and proportions in greater perfection than shown on the previous plates. Hamilton group. *Stafford, Genesee Co., N. Y.*

AVICULOPECTEN BELLUS.

Page 35.

See Plate 2.

Fig. 8. A right valve, × 2.

AVICULOPECTEN DUPLICATUS.

Page 17.

See Plate 7.

Fig. 9. A left valve showing the coarse radii on the pallial margin.
Chemung group. *Mansfield, Pa.*

Fig. 10. An entire right valve.
Chemung group. *Mansfield, Pa.*

AVICULOPECTEN RUGÆSTRIATUS.

Page 15.

See Plate 7.

Fig. 11. A right valve preserving the surface characters with considerable perfection.
Chemung group. *Rockville, N. Y.*

Fig. 12. Several of the radii, of the preceding specimen, enlarged two diameters to show the changes in surface ornamentation from the beak to the base.

AVICULOPECTEN PRINCEPS.

Page 1.

See Plates 1, 5, 6 and 24.

Fig. 13. A right valve showing the pallial line and muscular impression.
Hamilton group. *Ludlowville, N. Y.*

Fig. 14. A specimen with a portion of the left valve removed showing the interior of the right valve and the difference in size between the right and left valves.
Hamilton group. *Muttonville, Ontario Co., N. Y.*

Fig. 15. A left valve as preserved in limestone.
Hamilton group. *Delaware, Ohio.*

Fig. 16. A specimen preserved in a soft shale showing strong regular concentric striæ.
Hamilton group. *Livingston Co., N. Y.*

Fig. 17. An individual vertically imbedded in the shales showing the effects of compression and distortion.
Hamilton group. *N. Y.*

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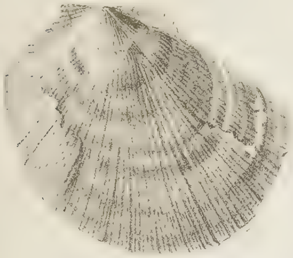

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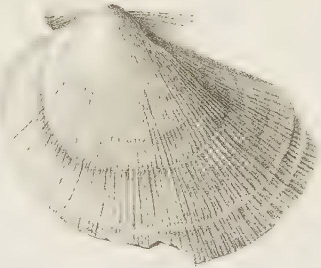

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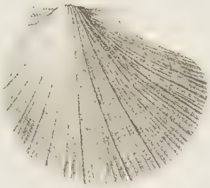

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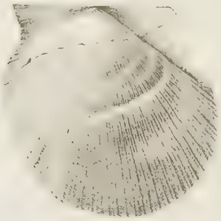

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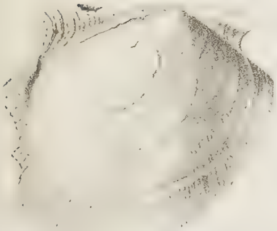

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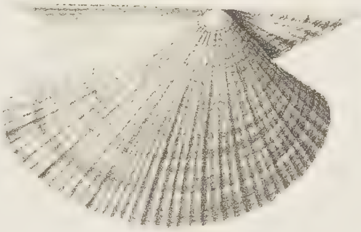

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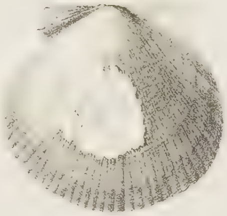

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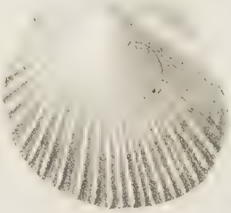

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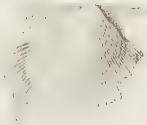

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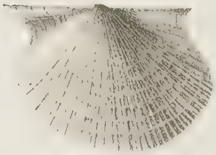

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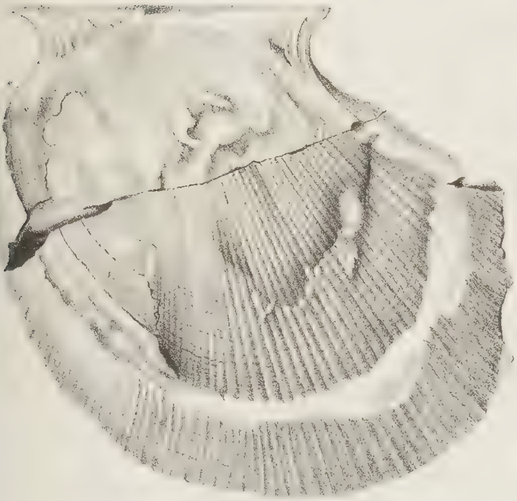

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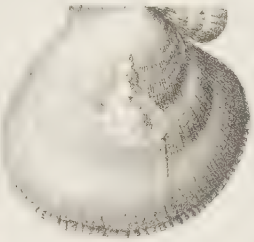

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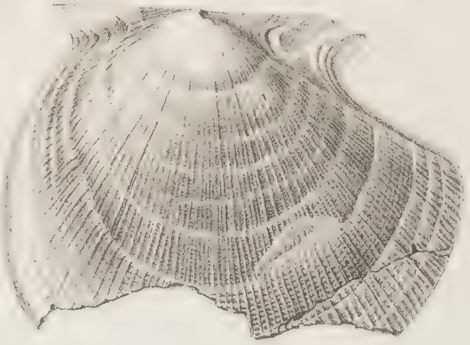

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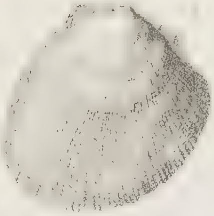

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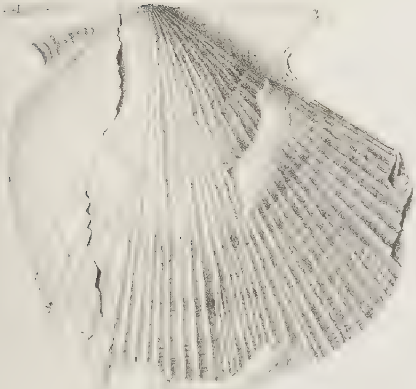

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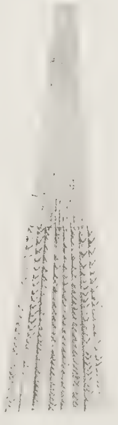

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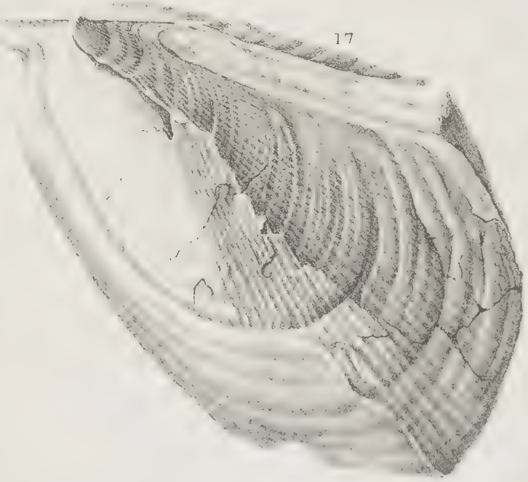

PLATE LXXXII.

AVICULOPECTEN ÆQUILATERALIS.

Page 19.

Fig. 1. A left valve showing the form and surface ornamentation.
Chemung group. *Alleghany Springs, Warren Co., Pa.*

LYRIOPECTEN ANOMIÆFORMIS.

Page 53.

See Plates 4 and 10.

Fig. 2. The specimen illustrated on plate 10, fig. 5, redrawn to show the proper form and surface ornamentation.
Chemung group. *Chemung creek, N. Y.*

LYRIOPECTEN ORBICULARIS.

Page 42.

See Plate 4.

Fig. 3. A specimen with the upper portion of the left valve removed, showing the exterior impression of the right valve and the comparative size of the two valves.
Hamilton group. *Canandaigua lake, N. Y.*

PTERINOPECTEN SUBORBICULARIS.

Page 80.

See Plates 8 and 24.

Fig. 4. A right valve of this species showing the deep byssal sinus.
Chemung group. *Mansfield, Pa.*

LYRIOPECTEN INTERRADIATUS.

Page 44.

See Plate 2.

Fig. 5. A large left valve showing the surface ornamentation and the ligamental area.
Hamilton group. *Schoharie Co., N. Y.*

LYRIOPECTEN PRIAMUS.

Page 54.

See Plate 10.

Fig. 6. A right valve of this species.
Chemung group. *Franklin, Delaware Co., N. Y.*

PTERINOPECTEN UNDOSUS.

Page 72.

See Plate 2.

Fig. 7. A left valve with comparatively few radii, and the strong characteristic concentric undulations.
Hamilton group. *Bethany, N. Y.*

PTERINOPECTEN REFLEXUS.

Page 58.

Fig. 8. A view of the interior of a left valve.
Corniferous limestone. *Ohio falls.*

PTERINOPECTEN FILITEXTUS.

Page 67.

See Plate 17.

Fig. 9. A specimen showing the interior of the right valve and preserving the pallial margin of the left valve. Hamilton group. *Onondaga creek, N. Y.*

Fig. 10. An enlargement, to three diameters, of a portion of the surface of the specimen illustrated on plate 17, fig. 22.

Hamilton group. *From a boulder, Pine Valley, N. Y.*

PTERINOPECTEN DISPANDUS.

Page 76.

Fig. 11. A right valve of this species.

Fig. 12. A left valve.

Chemung group. *Mansfield, Pa.*

PTERINOPECTEN NODOSUS.

Page 60.

Fig. 13. The imperfect left valve described, showing the characteristic nodose radii.

Corniferous limestone. *Ohio falls.*

PTERINOPECTEN CRENICOSTATUS.

Page 78.

See Plate 8.

Fig. 14. The specimen plate 8, fig. 4, redrawn and restored in outline to show the entire form and details of surface characters.

Chemung group. *Near Angelica, N. Y.*

PTERINOPECTEN ERECTUS.

Page 77.

Fig. 15. A specimen with the upper portion of the left valve broken away, showing the interior of the right valve.

Fig. 16. A left valve of medium size.

Fig. 17. A large left valve.

Chemung group. *Ithaca, N. Y.*

PTERINOPECTEN (AVICULOPECTEN ?) STRICTUS.

Page 74.

See Plate 24.

Fig. 18. A left valve, associated with the right valve illustrated on plate 24.

Chemung group. *Near Elmira, N. Y.*

PTERINEA (VERTUMNIA) REPROBA.

Page 106.

Fig. 19. A left valve.

Fig. 20. The convex right valve of a larger individual than the preceding.

Chemung group. *Ithaca, N. Y.*

AVICULOPECTEN (PTERINOPECTEN) INVALIDUS.

Page 31.

See Plate 1.

Fig. 21. The left valve, fig. 18, plate 1, drawn of natural size, showing the true form and proportions.

Marcellus shale. *Cherry Valley, N. Y.*

UPPER HELDERBERG TO CHEMUNG GROUP.

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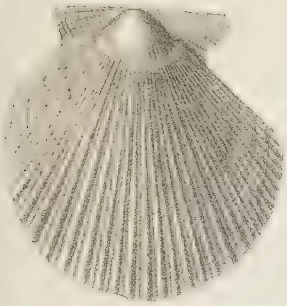

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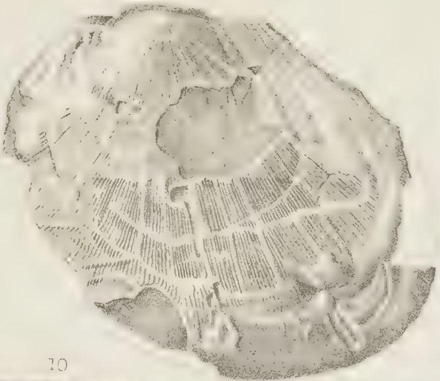

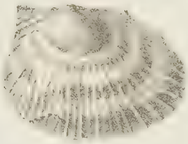

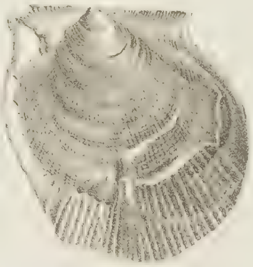

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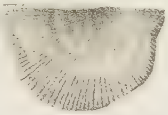

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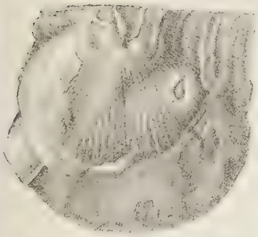

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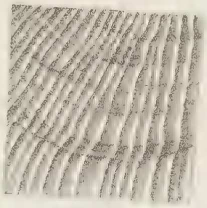

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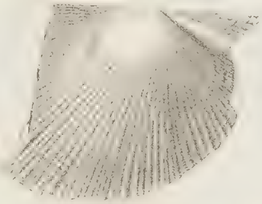

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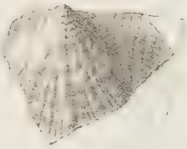

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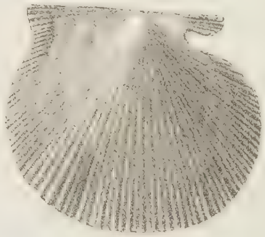

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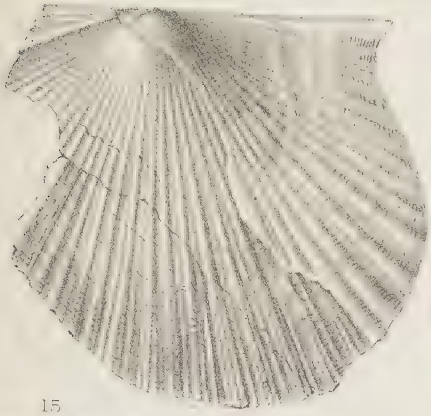

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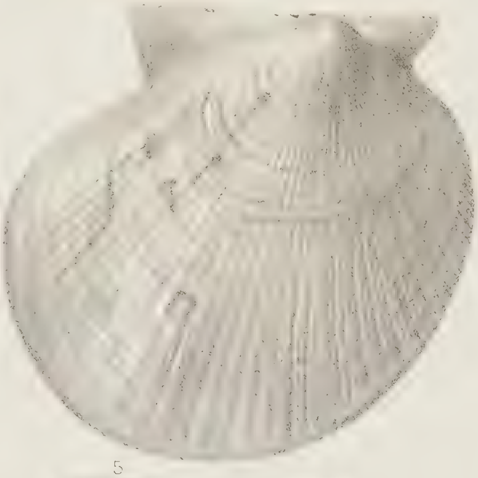

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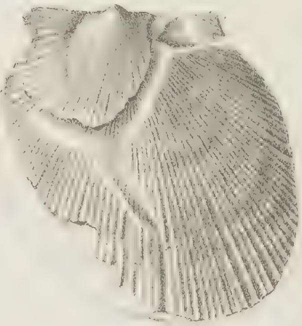

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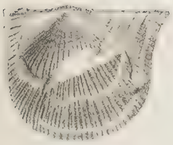

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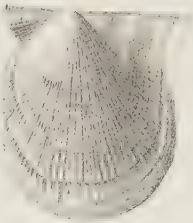

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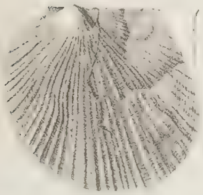

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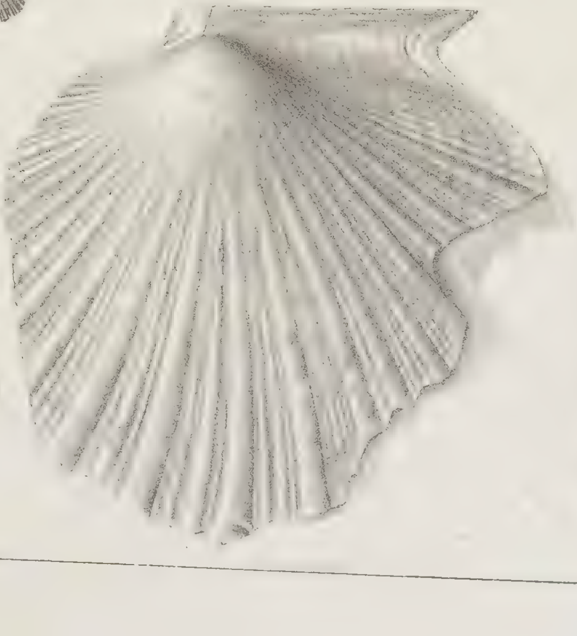

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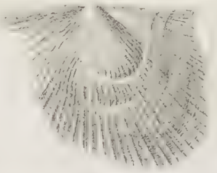

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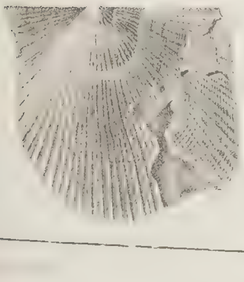

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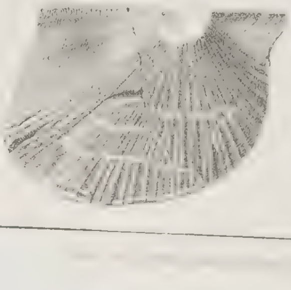

PLATE LXXXIII.

PTERINOPECTEN REGULARIS.

Page 70.

Fig. 1. A left valve showing the characteristic form and surface markings.
Hamilton group. *Livingston Co., N. Y.*

PTERINOPECTEN VERTUMNUS.

Page 71.

See Plate 5.

Fig. 2. A small specimen preserving the left valve entire and a portion of the right valve.
Hamilton group. *Onondaga Co., N. Y.*

Fig. 3. A left valve to show the characters of the surface ornamentation.
Hamilton group. *Skaneateles lake, N. Y.*

PTERINOPECTEN INTERMEDIUS.

Page 68.

See Plate 17.

Fig. 4. A left valve wholly denuded of the test.
Hamilton group. *Cayuga lake, N. Y.*

Fig. 5. A left valve as obtained from an impression of the exterior in the matrix, showing the form and surface markings.
Hamilton group. *Cayuga lake, N. Y.*

PTERINOPECTEN EXFOLIATUS.

Page 61.

See Plate 1.

Fig. 6. A left valve as obtained from an impression of the matrix, showing the form and surface characters.

Fig. 7. A large imperfect left valve with the test almost wholly exfoliated and presenting a strong contrast with the preceding.

Limestone of Marcellus shale. *Genesee Co., N. Y.*

CRENIPECTEN LEON.

Page 88.

See Plate 9.

Fig. 8. The left valve described showing the hinge characters and form of the valve.

Chemung group. *Leon, Cattaraugus Co., N. Y.*

CRENIPECTEN LIRATUS.

Page 87.

See Plate 9.

Fig. 9. A left valve showing the form and size of the ears given in correction of fig. 24, plate 9.

Chemung group. *Connewango, Cattaraugus Co., N. Y.*

CRENIPECTEN IMPOLITUS.

Page 83.

See Plate 9.

Fig. 10. A small left valve.

Chemung group. *Olean, N. Y.*

PTERINEA FLABELLA.

Page 93.

See Plates 14 and 15.

Fig. 11. A large left valve showing but three strong radii.

Chemung group. *Lawrenceville, Tioga Co., Pa.*

Fig. 12. The internal mould of a left valve, showing the ligamental area, lateral and cardinal teeth, pallial line and both muscular impressions.

Hamilton group. *Schoharie Co., N. Y.*

PTERINEA PINGUIS.

Page 92.

See Plate 15.

Fig. 13. A left valve showing the form and proportions; redrawn from the specimen of fig. 2, plate 15.

Upper Helderberg group. *Near Columbus, Ohio.*

PTERINEA GRANDIS.

Page 91.

Fig. 14. A large left valve imperfect on the anterior end.

Upper Helderberg group. *Lexington, Scott Co., Ind.*

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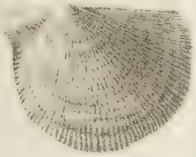

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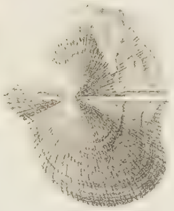

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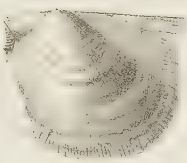

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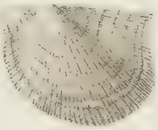

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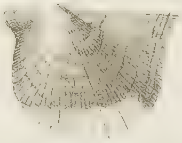

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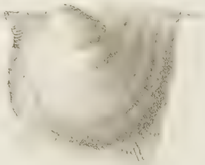

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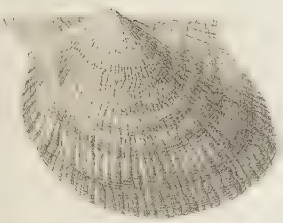

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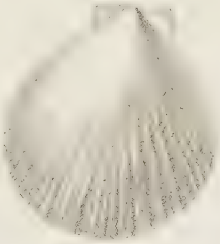

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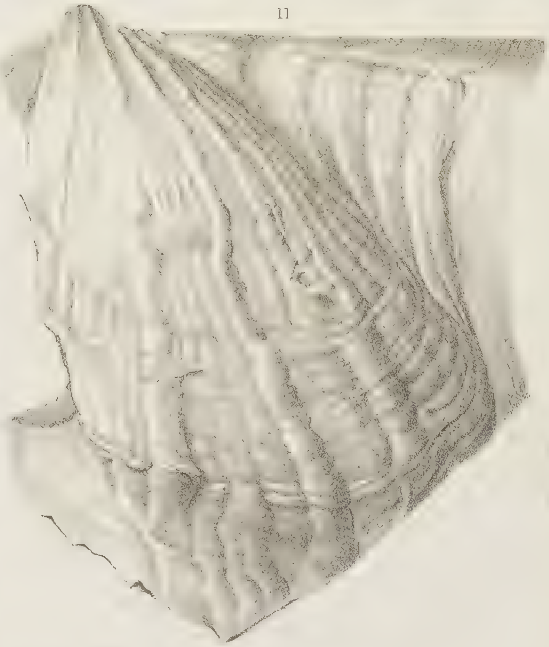

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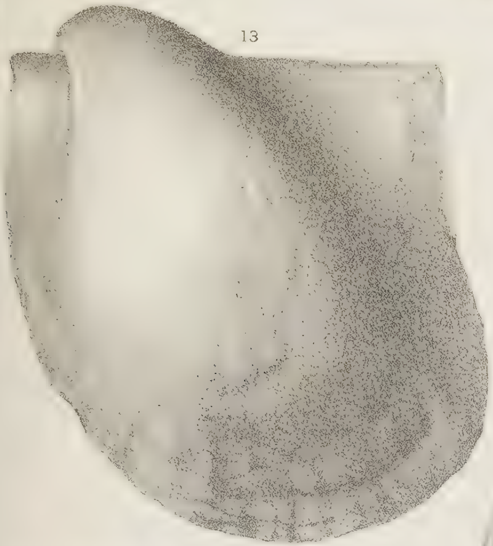

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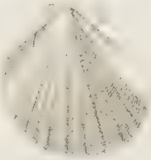

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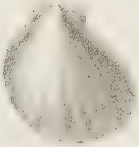

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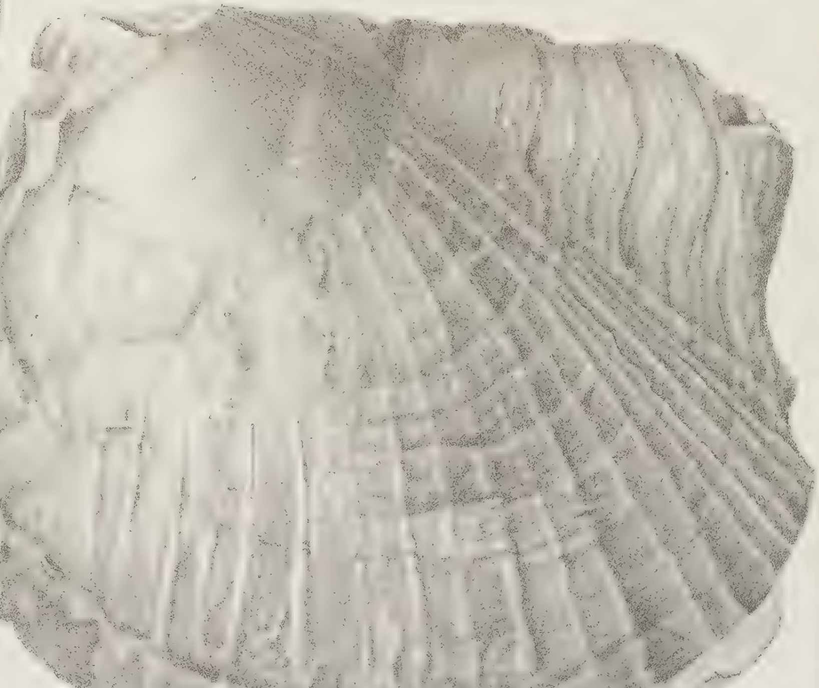

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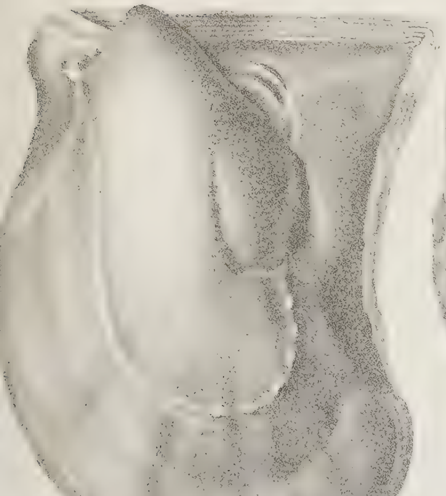

PLATE LXXXIV.

ACTINOPTERIA ZETA.

Page 123.

See Plate 23.

Fig. 1. A large left valve of this species.

Fig. 2. A smaller example preserving the surface ornamentation.

Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA PUSILLA.

Page 117.

Fig. 3. A right valve of this species.

Hamilton group. *Canandaigua lake, N. Y.*

ACTINOPTERIA DECUSSATA.

Page 111.

See Plates 17, 18 and 20.

Fig. 4. An enlargement of the surface of the specimen fig. 13, plate 18, showing the characters on another portion of the shell than represented in fig. 14 of the same plate.

Hamilton group. *Western N. Y.*

ACTINOPTERIA TENUISTRIATA.

Page 120.

Fig. 5. A left valve showing the usual characters.

Fig. 6. An enlargement of the surface from another specimen showing the regular coarse rays with finer rays between.

Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA IOTA.

Page 127.

Fig. 7. An imperfect left valve.

Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA ETA.

Page 124.

Fig. 8. A left valve as obtained from an impression of the matrix, showing the characters of the surface.

Fig. 9. A small left valve.

Fig. 10. A right valve of this species, showing the form and character of the surface.

Fig. 11. A left valve of medium size, somewhat narrowed by pressure, showing the cardinal expansions and surface markings.

Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA PERSTRIALIS.

Page 118.

See Plate 23.

Fig. 12. A right valve referred to this species.

Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA KAPPA.

Page 128.

Fig. 13. A left valve.

Chemung group. *Ithaca, N. Y.*

ACTINOPTERIA PEROBLIQUA.

Page 116.

See Plate 19.

Fig. 14. The left valve of the specimen fig. 31, plate 19, showing the pallial line and muscular impression with several umbonal scars.

Hamilton group. *Cazenovia, N. Y.*

ACTINOPTERIA AURICULATA.

Page 121.

Fig. 15. The left valve described showing the large anterior ear.
Chemung group. *Lawrenceville, Tioga Co., Pa.*

ACTINOPTERIA BOYDI.

Page 113.

See Plate 19.

Fig. 16. The left valve of the specimen figs. 26, 28, 29, plate 19, redrawn to show the pallial line and muscular impressions.
Hamilton group. *Cazenovia, N. Y.*

Fig. 17. A small right valve showing the hinge characters, pallial line and muscular impression. This figure is the natural size of the specimen represented in figure 12, plate 19.
Hamilton group. *Hamilton, Madison Co., N. Y.*

ACTINOPTERIA THETA.

Page 125.

Figs. 18, 19. The right and left valves of the specimen described.
Chemung group. *Ithaca, N. Y.*

ECTENODESMA BIROSTRATUM.

Page 242.

See Plate 23.

Fig. 20. The left valve represented on plate 23, fig. 30, redrawn to show the extent of the wings.
Chemung group. *Franklin, Delaware Co., N. Y.*

PTERINEA CHEMUNGENSIS.

Page 98.

See Plate 16.

Fig. 21. A large left valve of this species showing the form of the shell and the interrupted rays with the fine concentric striæ of the surface.
Chemung group. *Near Bath, N. Y.*

PTERINEA INTERSTRIALIS.

Page 96

Fig. 22. An imperfect left valve.
Chemung group. *Chemung Narrows, N. Y.*

PTERINEA CONSIMILIS.

Page 100.

See Plate 16.

Fig. 23. A left valve showing the ligamental area, cardinal and lateral teeth, pallial line and muscular impression. Some portions of the test are remaining on the lower half of the valve.
Chemung group. *Tioga Co., N. Y.*

PTERINEA (VERTUMNIA) REVERSA.

Page 104.

See Plate 24.

Fig. 24. The specimen represented on plate 24, fig. 6, redrawn to show the absence of strong rays on the wing.
Chemung group. *Elmira, N. Y.*

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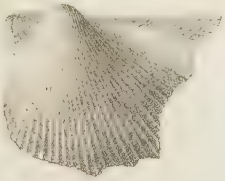

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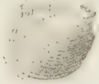

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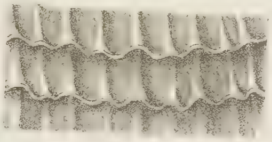

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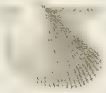

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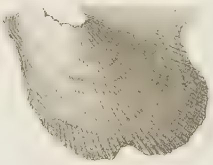

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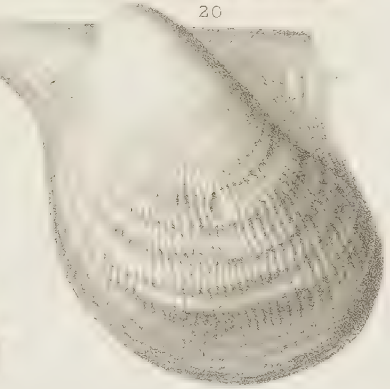

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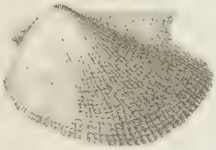

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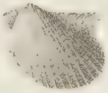

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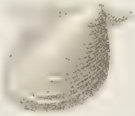

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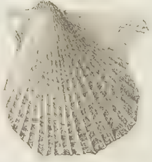

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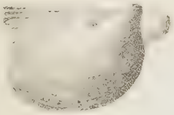

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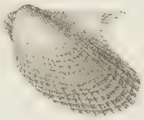

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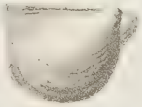

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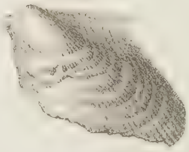

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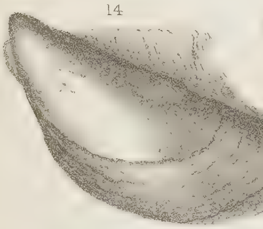

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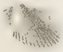

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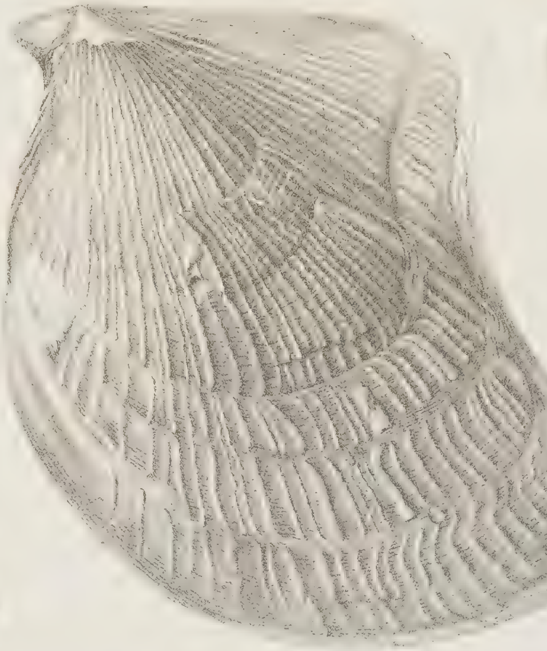

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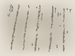

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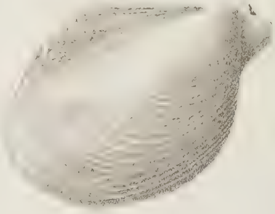

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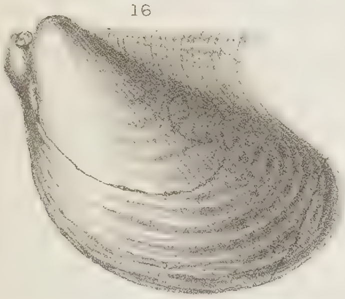

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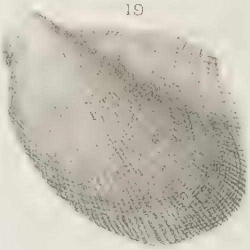

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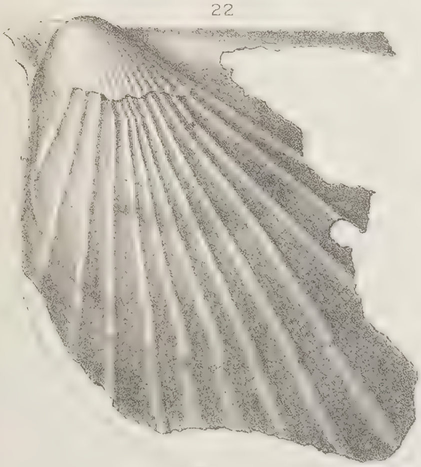

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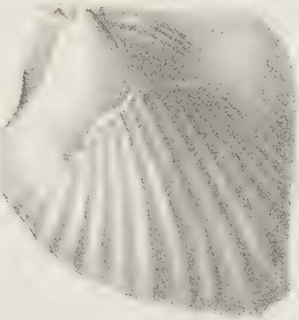

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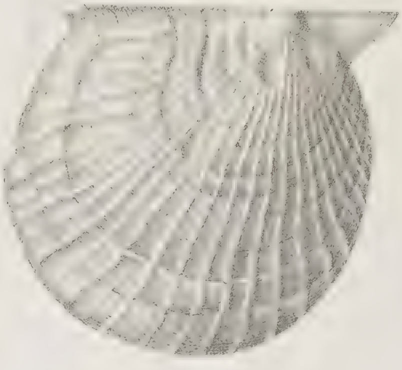


PLATE LXXXV.

PTYCHOPTERIA THETIS.

Page 135.

Figs. 1-3. Three left valves showing some variation in form and obliquity.
Fig. 4. A right valve referred to this species.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA GIBBOSA.

Page 149.

Fig. 5. A left valve showing the large anterior end and short wing, with the broadly gibbous body of the valve. Chemung group. *Warren, Pa.*

PTYCHOPTERIA FALCATA.

Page 136.

Fig. 6. An entire left valve, showing the form and surface markings.
Fig. 7. A smaller example of the same valve.
Chemung group. *Alleghany Springs, Warren Co., Pa.*

PTYCHOPTERIA SINUOSA.

Page 130.

See Plate 23.

Fig. 8. A left valve showing the oblique cardinal and lateral teeth.
Chemung group. *Warren, Pa.*

PTYCHOPTERIA EUDORA.

Page 138.

Fig. 9. A left valve of this species showing its elongate form.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA ELONGATA.

Page 141.

Fig. 10. A cardinal view of a specimen preserving both valves.
Fig. 11. The ventral view of a smaller specimen with the valves closed.
Fig. 12. A large right valve of this species.
Fig. 13. The left valve of the specimen fig. 10.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA SAO.

Page 132.

See Plate 23.

Fig. 14. A small left valve.
Fig. 15. The left valve of a larger example.
Fig. 16. A specimen of medium size.
Fig. 17. The cardinal view of a small individual, showing the prominent beak and umbo of the left valve as compared with the right.
Fig. 18. The ventral view of a specimen preserving both valves.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA SPIO.

Page 137.

Fig. 19. A left valve of this species.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA SPATULATA.

Page 144.

Fig. 20. A left valve showing its large size and broad elongate form.
Chemung group. *Warren, Pa.*

PTYCHOPTERIA BEECHERI.

Page 143.

Fig. 21. An entire left valve showing its gibbous and arcuate form.
Fig. 22. A right valve of this species.
Chemung group. *Warren, Pa.*

PTYCHOPTERIA LATA.

Page 145.

Fig. 23. An entire left valve.
Fig. 24. A larger left valve.
Fig. 25. A right valve showing its comparatively strong alar fold.
Chemung group. *Warren, Pa.*

PTYCHOPTERIA ALATA.

Page 139.

See Plate 23.

Fig. 26. The posterior half of a left valve, showing the subangular posterior slope.
Chemung group. *Salamanca, N. Y.*

PTYCHOPTERIA EUCRATE.

Page 133.

See Plate 23.

Fig. 27. A left valve of this species.
Fig. 28. A small left valve.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA GALENE.

Page 142.

Fig. 29. A left valve flattened by pressure.
Fig. 30. A smaller left valve preserving the normal proportions of the species.
Fig. 31. The right valve of a specimen preserving both valves.
Chemung group. *Warren, Pa.*

PTYCHOPTERIA THALIA.

Page 148.

Fig. 32. A small right valve.
Fig. 33. A medium sized left valve showing the short gibbous form of the shell.
Chemung group. *Alleghany Springs, Warren Co., Pa.*

PTYCHOPTERIA TRIGONALIS.

Page 140.

Fig. 34. A small left valve showing the form and characters of the species.
Fig. 35. A large imperfect left valve.
Chemung group. *Panama, N. Y.*

PTYCHOPTERIA VANUXEMI.

Page 151.

Fig. 36. A portion of a large left valve, showing the peculiar form of the body and the surface characters.
Chemung group. *Warren, Pa.*

PTYCHOPTERIA LOBATA.

Page 150.

Fig. 37. A left valve showing the short form of the valve and the strong alar plication.
Chemung group. *Warren, Pa.*

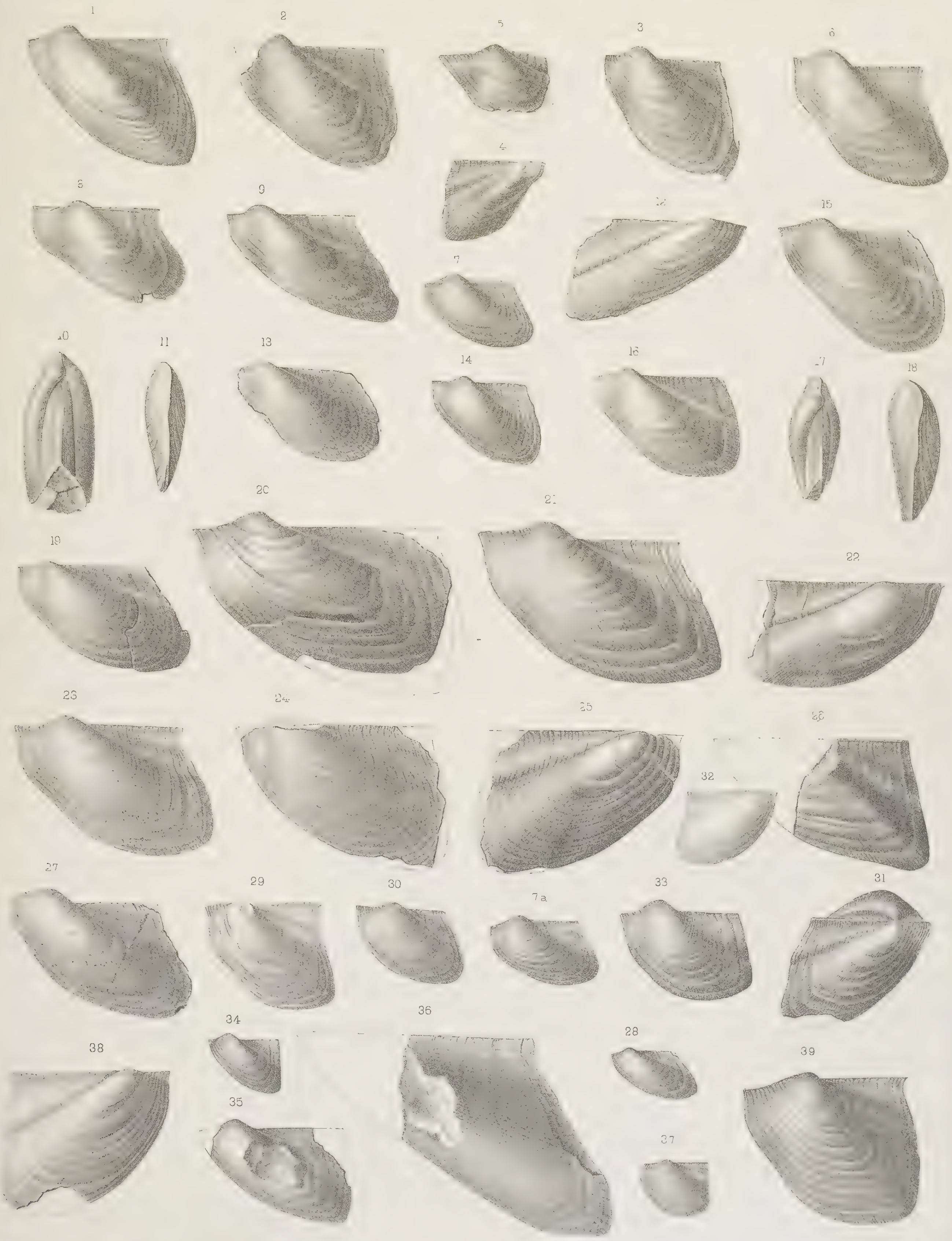
PTYCHOPTERIA PERLATA.

Page 147.

Fig. 38. A right valve of this species.
Fig. 39. A left valve showing the form and surface markings.
Chemung group. *Warren, Pa.*

CHEMUNG GROUP.

Plate LXXXV.



Emmons del.

PLATE LXXXVI.

GLYPTODESMA ERECTUM.

Page 153.

See Plates 11, 12, 13, 25 and 87.

Fig. 1. A left valve of a small individual.
Hamilton group. *Fabius, Onondaga Co., N. Y.*

Fig. 2. The right valve, as seen lying within the left, showing its form and comparative size.
Hamilton group. *Cayuga lake, N. Y.*

Fig. 3. The hinge of a specimen, showing the striated ligamental area and strong cardinal folds.
Hamilton group. *Delphi, Onondaga Co., N. Y.*

Fig. 4. A small left valve with small anterior wing and very large posterior wing, also showing one of the oblique lateral teeth.
Hamilton group. *Cayuga lake, N. Y.*

Fig. 5. The anterior profile view of a very perfect specimen retaining the test, showing the comparative convexity of the valves.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 6. The left valve fig. 8, plate 11, redrawn to show the ligamental area, lateral teeth and muscular impression. The tubular markings around the margin are the remains of the excavations made by boring sponges.
Hamilton group. *Cazenovia, N. Y.*

Fig. 7. A large right valve, showing the ligamental area, pallial line, muscular impression and umbonal pits.
Hamilton group. *Gilbertsville, Otsego Co., N. Y.*

Fig. 8. A left valve presenting the same internal characters as the preceding, together with two strong lateral teeth.
Hamilton group. *Albany Co., N. Y.*

GLYPTODESMA OCCIDENTALE.

Page 157.

See Plate 15.

Fig. 9. The specimen of fig. 12, plate 15, redrawn to show the erect form of the body and extent of the posterior cardinal expansion.
Upper Helderberg group. *Falls of the Ohio.*

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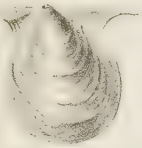

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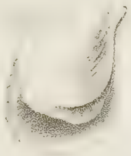

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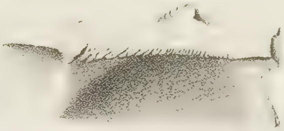

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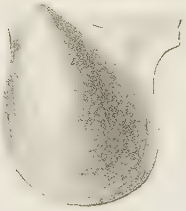

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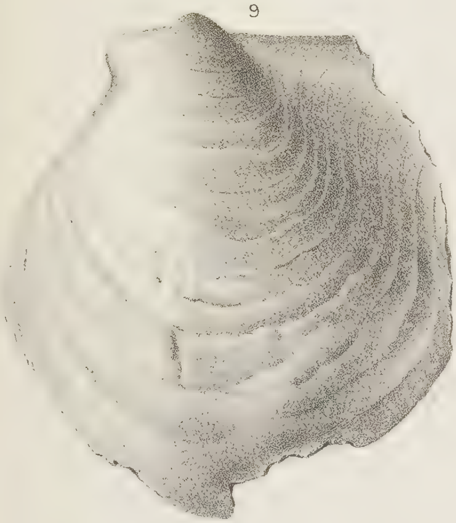

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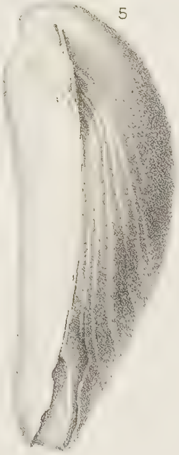

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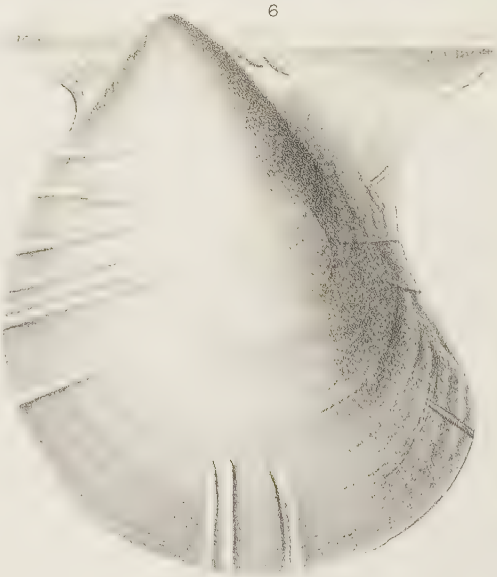

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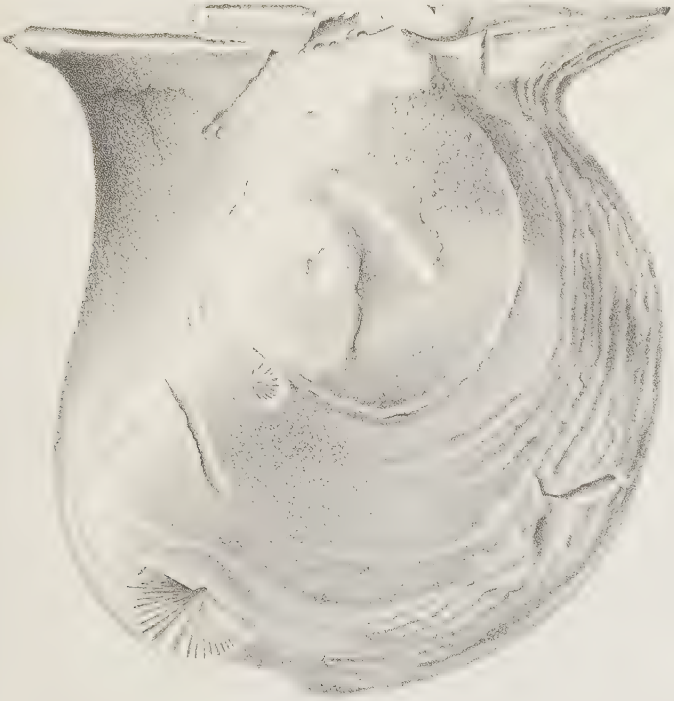

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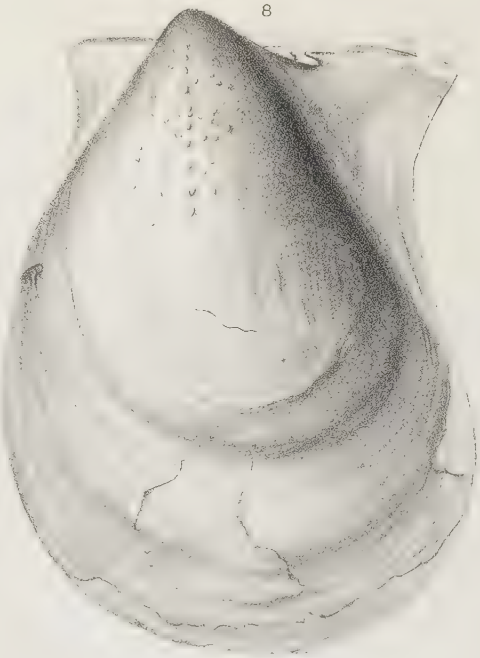


PLATE LXXXVII.

GLYPTODESMA ERECTUM.

Page 153.

See Plates 11, 12, 13, 25 and 86.

Fig. 1. The interior of a specimen with the valves thrown open, showing the comparative size and form of the valves, the hinge characters and muscular markings.
Hamilton group. *Delphi, Onondaga Co., N. Y.*

Fig. 2. The internal mould of a left valve, showing the pallial line, muscular impression and small tubercles in the inter-pallial area, representing the points of attachment of small umbonal muscles.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 3. An internal mould of a right valve showing the anterior and posterior adductor muscular impressions, and a small Crania attached to the wing.
Hamilton group. *From a boulder, Waverly, Tioga Co., N. Y.*

PALÆOPINNA FLABELLA.

Page 240.

See Plate 25.

Fig. 4. The left valve described, showing the form of the shell and a single groove along the hinge.
Oriskany sandstone. *Schoharie, N. Y.*

PTERONITES INOPTATUS.

Page 239.

Fig. 5. A left valve showing the form of the shell. The scar on the post-umbonal slope was produced by the attachment of a Crania.
Chemung group. *Mansfield, Pa.*

MYTILARCA FIBRISTRIATA.

Page 264.

See Plate 33.

Fig. 6. The left valve fig. 6, plate 33, redrawn to show the true form of the anterior side. This species is the only radiate form of the genus yet described and more perfect material may show characters which would exclude it from Mytilarca.
Yellow sandstone. *Burlington, Iowa.*

MYTILARCA GIBBOSA.

Page 262.

See Plate 33.

Fig. 7. The left valve fig. 20, plate 33, redrawn to show more clearly the entire form of the valve.
Chemung group. *Napoli, Cattaraugus Co., N. Y.*

MYTILARCA (PLETHOMYTILUS) OVIFORMIS.

Page 255.

See Plate 31.

Fig. 8. The upper portion of a right valve showing the oblique posterior teeth of the hinge.
Hamilton group. *York, Livingston Co., N. Y.*

MODIOLA (MYTILOPS) METELLA.

Page 268.

See Plate 33.

Fig. 9. A right valve showing the form and proportions of the shell.
Chemung group. *Warren, Pa.*

MYTILARCA (PLETHOMYTILUS) ARENACEA.

Page 253.

See Plate 30.

Fig. 10. A left valve.
Schoharie grit. *Schoharie, N. Y.*

MYTILARCA OCCIDENTALIS.

Page 263.

See Plate 33.

Fig. 11. The left valve fig. 5, plate 33, redrawn to show the form of the beak and anterior side. The outlines of this one and of fig. 6 are partially restored from other specimens and represent all that can be determined from the imperfect material.
Yellow sandstone. *Burlington, Iowa.*

GOSSELETTIA TRIQUETRA.

Page 265.

See Plate 31.

Fig. 12. A large right valve of elongate form.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

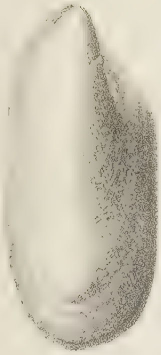
MYTILARCA (PLETHOMYTILUS) KNAPPI.

Page 256.

Fig. 13. The right valve described, showing the form of the shell and the striated ligamental area.
Hamilton group. *Skaneateles lake, N. Y.*

ORISKANY SANDSTONE TO CHEMUNG GROUP.

6



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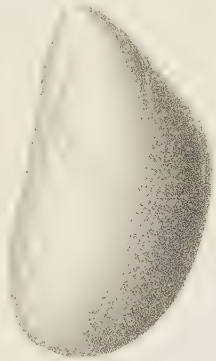

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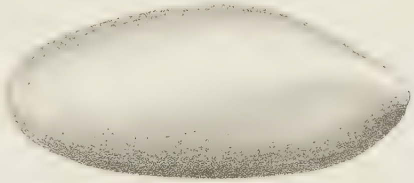

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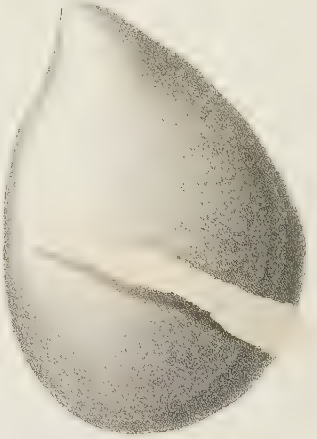

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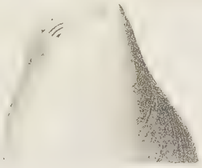

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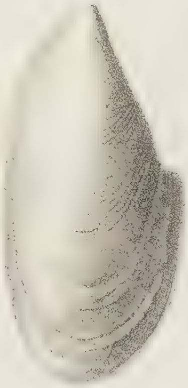

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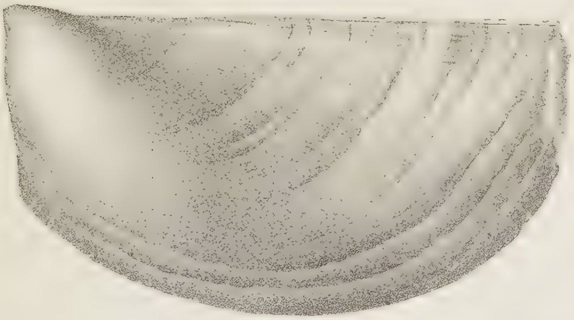

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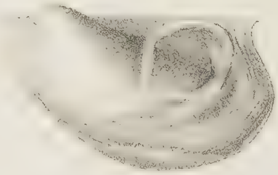

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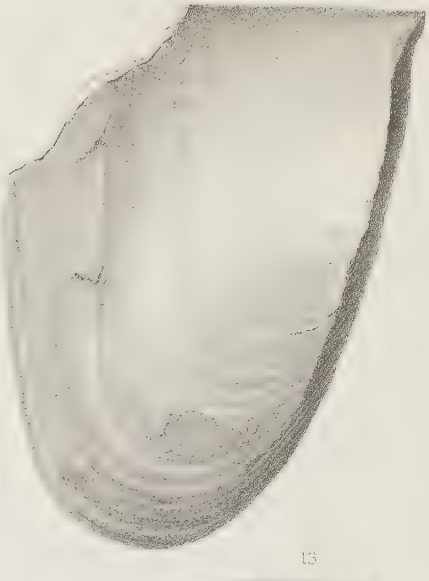

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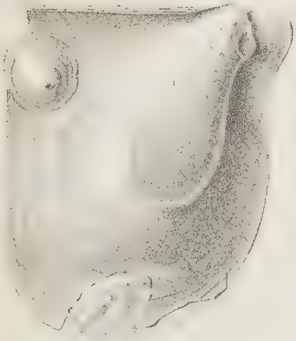

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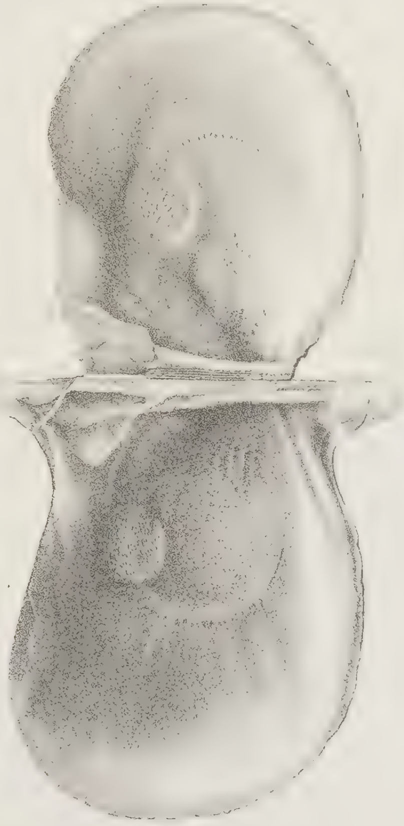

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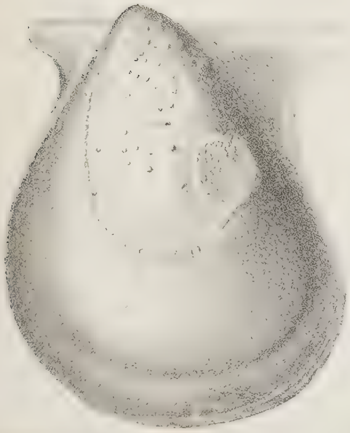

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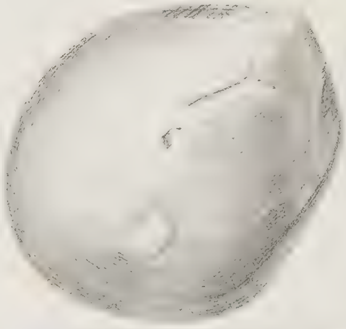

PLATE LXXXVIII.

LEIOPTERIA CONRADI.

Page 159.

See Plate 20.

Fig. 1. A left valve showing strong concentric undulations.
Hamilton group. *Leonardsville, Madison Co., N. Y.*

Fig. 2. A small left valve.
Hamilton group. *Canandaigua lake, N. Y.*

Fig. 3. A large left valve imperfect on the anterior side. This figure is given in correction of fig. 4, plate 20.

Fig. 4. An imperfect right valve.
Hamilton group. *Skaneateles lake, N. Y.*

LEIOPTERIA DEKAYI.

Page 164.

See Plates 19 and 20.

Fig. 5. The internal mould of a specimen preserving both valves, and showing the vertical plate just anterior to the beaks.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 6. A large left valve with the wing partially restored.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 7. An enlargement of the surface on the umbonal slope of the specimen fig. 10.

Fig. 8. A left valve preserving the striated ligamental area.

Fig. 9. A cardinal view of a portion of both valves showing the deep sulci anterior to the beaks.
Hamilton group. *Fultonham, Schoharie Co., N. Y.*

Fig. 10. A small left valve showing the fine concentric striæ of the test.
Hamilton group. *Delphi, Onondaga Co., N. Y.*

LEIOPTERIA TORREYI.

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See Plate 22.

Fig. 11. A left valve of this species.
Chemung group. *Panama, Chautauqua Co., N. Y.*

LEIOPTERIA TROOSTI.

Page 167.

Fig. 12. A left valve showing the form and surface characters.

Fig. 13. A portion of the surface enlarged to three diameters.
Hamilton group. *Schoharie Co., N. Y.*

LEIOPTERIA GABBI.

Page 169.

Fig. 14. A left valve showing the form and surface characters.
Hamilton group. *Cayuga lake, N. Y.*

LEIOPTERIA SAYI.

Page 162.

Fig. 15. An imperfect left valve preserving very fine concentric lines.
Hamilton group. *Norton's Landing, Cayuga lake, N. Y.*

Fig. 16. The left valve of a specimen preserving both valves, showing the extent of the wing and general form of the shell.
Hamilton group. *Livingston Co., N. Y.*

Fig. 17. The right valve of a large specimen with the valves partially opened.
Hamilton group. *Bellona, N. Y.*

Fig. 18. A left valve preserving the auricle and wing nearly entire. The body of the shell has been subjected to pressure and distortion in the soft shale and does not represent the true form and obliquity.
Hamilton group. *Bellona, N. Y.*

Fig. 19. An imperfect left valve as preserved in a coarse grit.
Hamilton group. *Leonardsville, Madison Co., N. Y.*

Fig. 20. A small left valve of considerable gibbosity.
Hamilton group. *Schoharie Co., N. Y.*

LEIOPTERIA GREENI.

Page 160.

See Plate 20.

Fig. 21. A large left valve. The figure is restored on the beak and anterior side.
Hamilton group. *Bellona, Yates Co., N. Y.*

Fig. 22. An imperfect right valve.
Hamilton group. *Canandaigua lake, N. Y.*

LEIOPTERIA BIGSBYI.

Page 165.

See Plate 20.

Fig. 23. A small right valve referred to this species.
Hamilton group. *N. Y.*

LEIOPTERIA LEAI.

Page 168.

Fig. 24. A small left valve.

Fig. 25. A larger imperfect left valve associated with the preceding.
Hamilton group. *Schoharie Co., N. Y.*

LEIOPTERIA MITCHELLI.

Page 166.

See Plate 20.

Fig. 26. A large imperfect left valve as obtained from the impression of the exterior of the valve in the matrix.
Hamilton group. *Schoharie Co., N. Y.*

LEIOPTERIA RAFINESQUII.

Page 161.

See Plates 15 and 20.

Fig. 27. A nearly entire left valve showing the form and the strong concentric undulations.
Hamilton group. *Bellona, N. Y.*

Fig. 28. A right valve referred to this species. The specimen is imperfect at the beak and extremity of the wing.
Hamilton group. *Leonardsville, N. Y.*

LEIOPTERIA LINGUIFORMIS.

Page 173.

Fig. 29. A left valve, denuded of the test, showing the general form with the pallial line and muscular impression.
Chemung group. *North of Binghamton, N. Y.*

HAMILTON AND CHEMUNG GROUPS

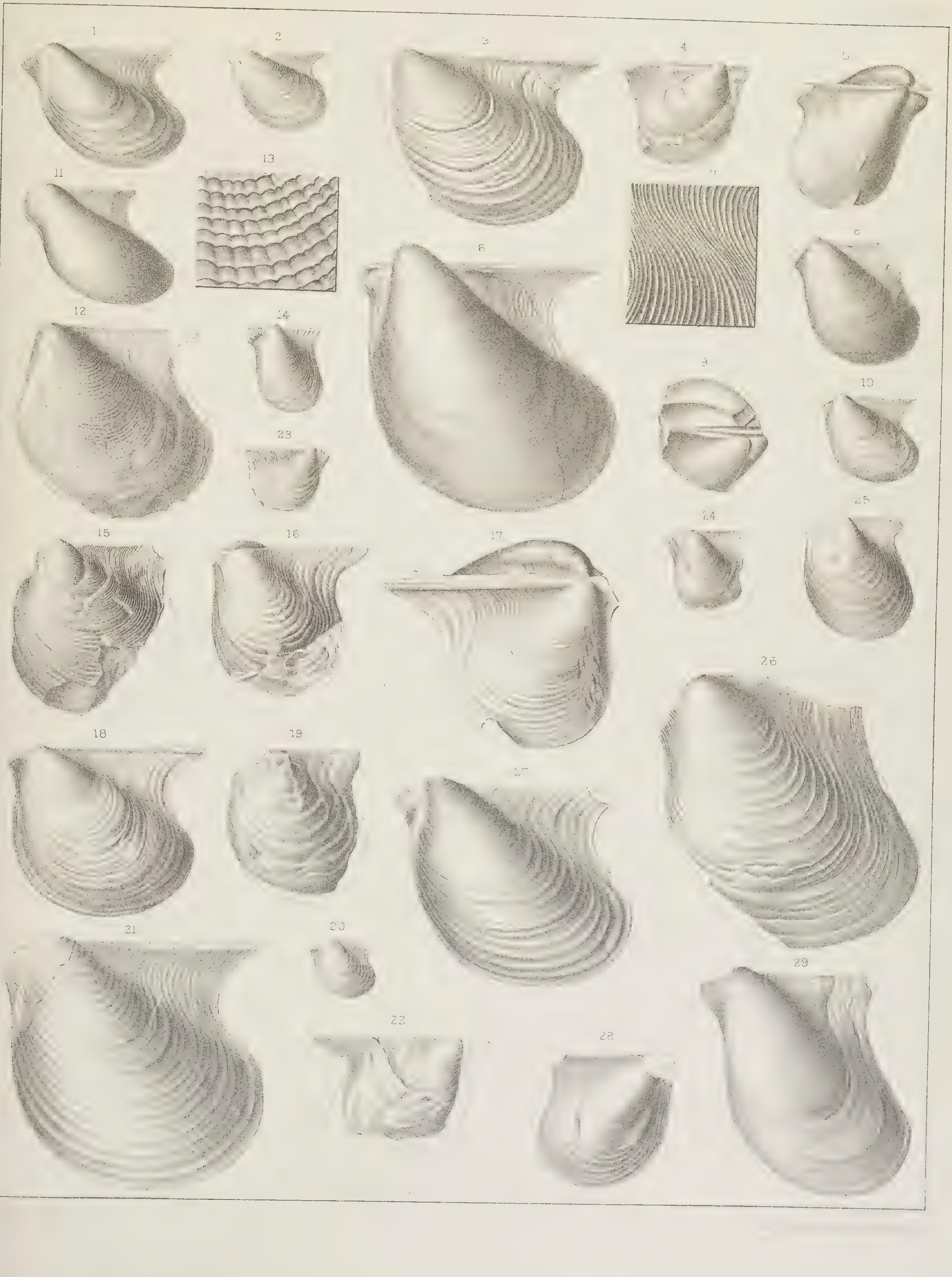

PLATE LXXXIX.

a—Spinifera.

Leptodesma spinigerum.

Page 177.

See Plate 21.

Fig. 1. A left valve preserving the spiniform extension of the cardinal angle.
Chemung group. *Chemung river, above Elmira, N. Y.*

Leptodesma longispinum.

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See Plate 21.

Figs. 2, 3. Two left valves varying slightly in form and surface markings.
Fig. 4. A large imperfect right valve preserving a portion of the finely striated ligamental area.
Chemung group. *Near Elmira, N. Y.*

Leptodesma Shumardi.

Page 180.

Figs. 5, 6. Two left valves varying somewhat in form and proportions.
Chemung group. *Near Elmira, N. Y.*

Leptodesma potens.

Page 188.

See Plates 21 and 22.

Fig. 7. A nearly entire right valve of this species.
Chemung group. *Near Olean, N. Y.*

Leptodesma robustum.

Page 181.

See Plate 21.

Fig. 8. A large left valve.
Chemung group. *Steuben Co., N Y.*

Leptodesma Mortoni.

Page 190.

See Plate 21.

Fig. 9. The specimen fig. 31, plate 21, redrawn to show the form of the body and size of the wing.
Chemung group. *Portville, Cattaraugus Co., N. Y.*

Fig. 10. The right valve fig. 32, plate 21, redrawn to show the proper form and characters of this valve.
Chemung group. *Portville, N. Y.*

Fig. 11. A cardinal view of a specimen, preserving the valves partially open and showing their comparative size. Chemung group. *Little Genesee, N. Y.*

Leptodesma Billingsi.

Page 192.

Fig. 12. A large left valve.
Chemung group. *Panama, N. Y.*

Fig. 13. A right valve agreeing in form and proportions with this species, but referred with some doubt on account of the geological position.
Chemung group. *Near Elmira, N. Y.*

Fig. 14. An imperfect left valve of somewhat different form.
Chemung group. *Panama, N. Y.*

Fig. 15. A small left valve from the same horizon as the specimen fig. 13.

Leptodesma lepidum.

Page 195.

See Plate 21.

Fig. 16. A left valve showing the form and surface markings.
Chemung group. *Tioga Co., Pa.*

Leptodesma Agassizi.

Page 182.

Figs. 17, 18. Two left valves showing the characteristic form of this species.

Fig. 19. A small right valve.
Chemung group. *Near Elmira, N. Y.*

Leptodesma Stephani.

Page 194.

Fig. 20. A right valve.

Figs. 21, 22. Two left valves showing the usual characters of the species.
Chemung group. *Bradford, Pa.*

Leptodesma disparile.

Page 186.

See Plate 25.

Fig. 23. A right valve showing the form and ornamentation.

Fig. 24. A small left valve preserving the spiniform process.
Chemung group. *McKean Co., Pa.*

CHEMUNG GROUP.

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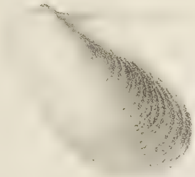

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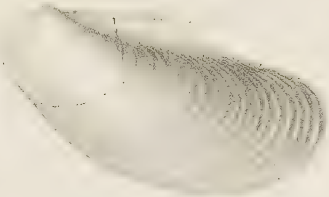

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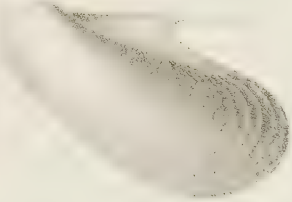

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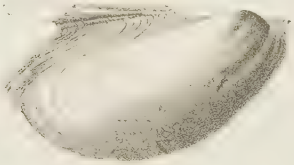

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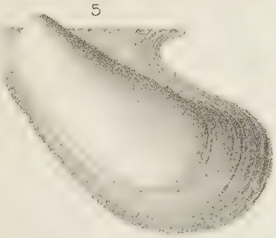

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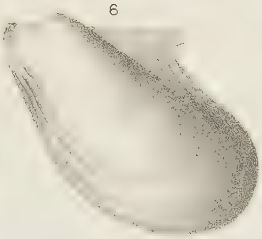

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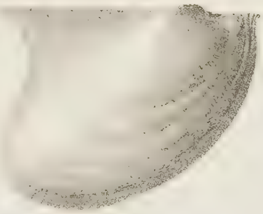

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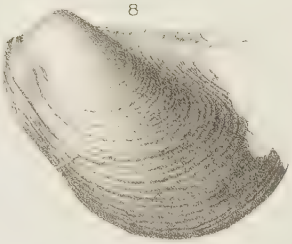

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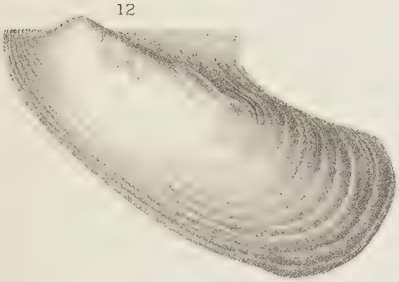

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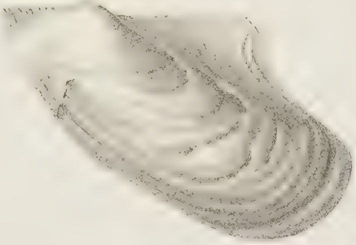

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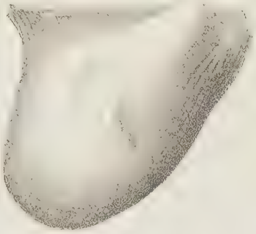

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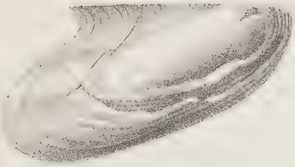

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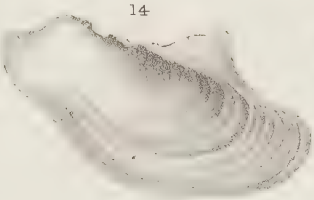

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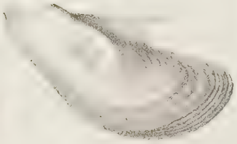

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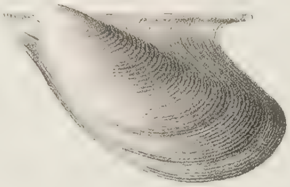

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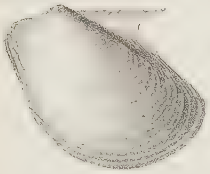

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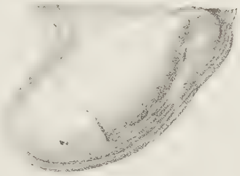

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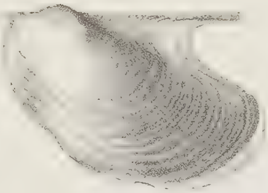

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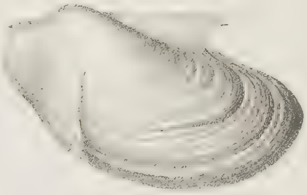

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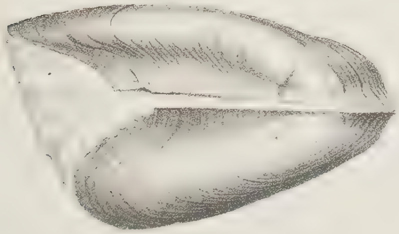

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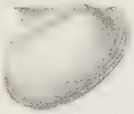

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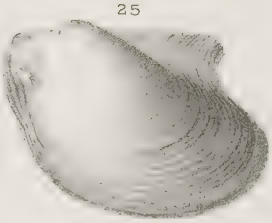

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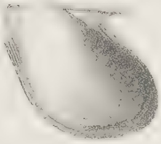

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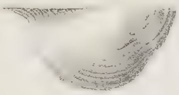

Emmons del.

PLATE XC.

b—Umbonata.

LEPTODESMA MEDON.

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Figs. 1-3. Three left valves varying somewhat in form and size.

Fig. 4. A right valve of this species.

Chemung group. *Lawrenceville, Tioga Co., Pa.*

LEPTODESMA MENTOR.

Page 205.

See Plate 23.

Fig. 5. A left valve of the usual form.

Chemung group. *Smethport, Pa.*

LEPTODESMA CADMUS.

Page 201.

Fig. 6. A left valve of a specimen preserving both valves partly open.

Chemung group. *Smithfield, Bradford Co., Pa.*

Fig. 7. A large left valve.

Chemung group. *Steuben Co., N. Y.*

LEPTODESMA ORODES.

Page 206.

See Plate 25.

Fig. 8. The specimen fig. 9, plate 25, redrawn to show the true form of the body and wing.

Chemung group. *Smethport, Pa.*

LEPTODESMA UMBONATUM.

Page 198.

See Plate 22.

Fig. 9. The specimen fig. 13, plate 22, redrawn to show its proper form and proportions.

Chemung group. *Twenty Mile creek, Chautauqua Co., N. Y.*

LEPTODESMA UMBONATUM, var. DEPRESSUM.

Page 199.

See Plate 22.

Fig. 10. The specimen fig. 14, plate 22, redrawn and restored in outline.

Chemung group. *Napoli Centre, Cattaraugus Co., N. Y.*

LEPTODESMA CREON.

Page 202.

Figs. 11, 12. Two left valves showing slight differences in form and surface markings.

Fig. 13. A right valve.

Chemung group. *Lawrenceville, Tioga Co., Pa.*

LEPTODESMA LOXIAS.

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Fig. 14. A left valve of this species.

Chemung group. *Lawrenceville, Tioga Co., Pa.*

LEPTODESMA DEMUS.

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Figs. 15, 16. A right and left valve showing the usual form of the shell.

Chemung group. *Lawrenceville, Tioga Co., Pa.*

c—Rostrata.

LEPTODESMA EXTENUATUM.

Page 207.

See Plate 22.

Fig. 17. The specimen fig. 23, plate 22, redrawn to show the entire form and proportions.

Fig. 18. A right valve with the test removed showing the pallial line and muscular impression.

Chemung group. *Mansfield, Tioga Co., Pa.*

LEPTODESMA HECTOR.

Page 209.

Figs. 19, 20. The left and right valves of this species The right valve preserves the pallial line and muscular impression.

Chemung group. *Canton, Bradford Co., Pa.*

LEPTODESMA CLITUS.

Page 210.

Fig. 21. A left valve, showing the form and surface markings.

Chemung group. *Mansfield, Pa.*

LEPTODESMA CORYDON.

Page 212.

Fig. 22. The left valve described.

Chemung group. *Mansfield, Pa.*

LEPTODESMA ORCUS.

Page 215.

Fig. 23. A left valve.

Chemung group. *Mansfield, Pa.*

LEPTODESMA TRUNCATUM.

Page 211.

Figs. 24, 25. A right and left valve of this species.

Chemung group. *Mansfield, Pa.*

LEPTODESMA ALATUM.

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Fig. 26. A left valve.

Fig. 27. A right valve preserving the pallial line and muscular impression. The apparent anterior muscular scar is due to a defect in the shell, as the pallial line can be traced to a point just anterior to the beak.

Chemung group. *Canton, Bradford Co., Pa.*

LEPTODESMA PELOPS.

Page 214.

Figs. 28, 29. Two left valves varying slightly in form and proportions.

Chemung group. *Mansfield, Pa.*

LEPTODESMA ORUS.

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Fig. 30. A left valve showing the form and surface markings.

Chemung group. *Mansfield, Pa.*

LEPTODESMA NEREUS.

Page 217.

Fig. 31. A mould of an imperfect right valve lying in the left valve, showing the oblique lateral teeth, the pallial line and muscular impression.

Figs. 32, 33. Two left valves: fig. 33 shows an oblique lateral tooth corresponding to the two in the right valve represented in figure 31.

Chemung group. *Mansfield, Pa.*

LEPTODESMA LYSANDER.

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See Plate 22.

Fig. 34. A left valve, showing the form and regular concentric striæ of the surface.

Chemung group. *Mansfield, Pa.*

CHEMUNG GROUP.

Palæontology of N.Y. Vol V. Pt.I.

Plate XC.

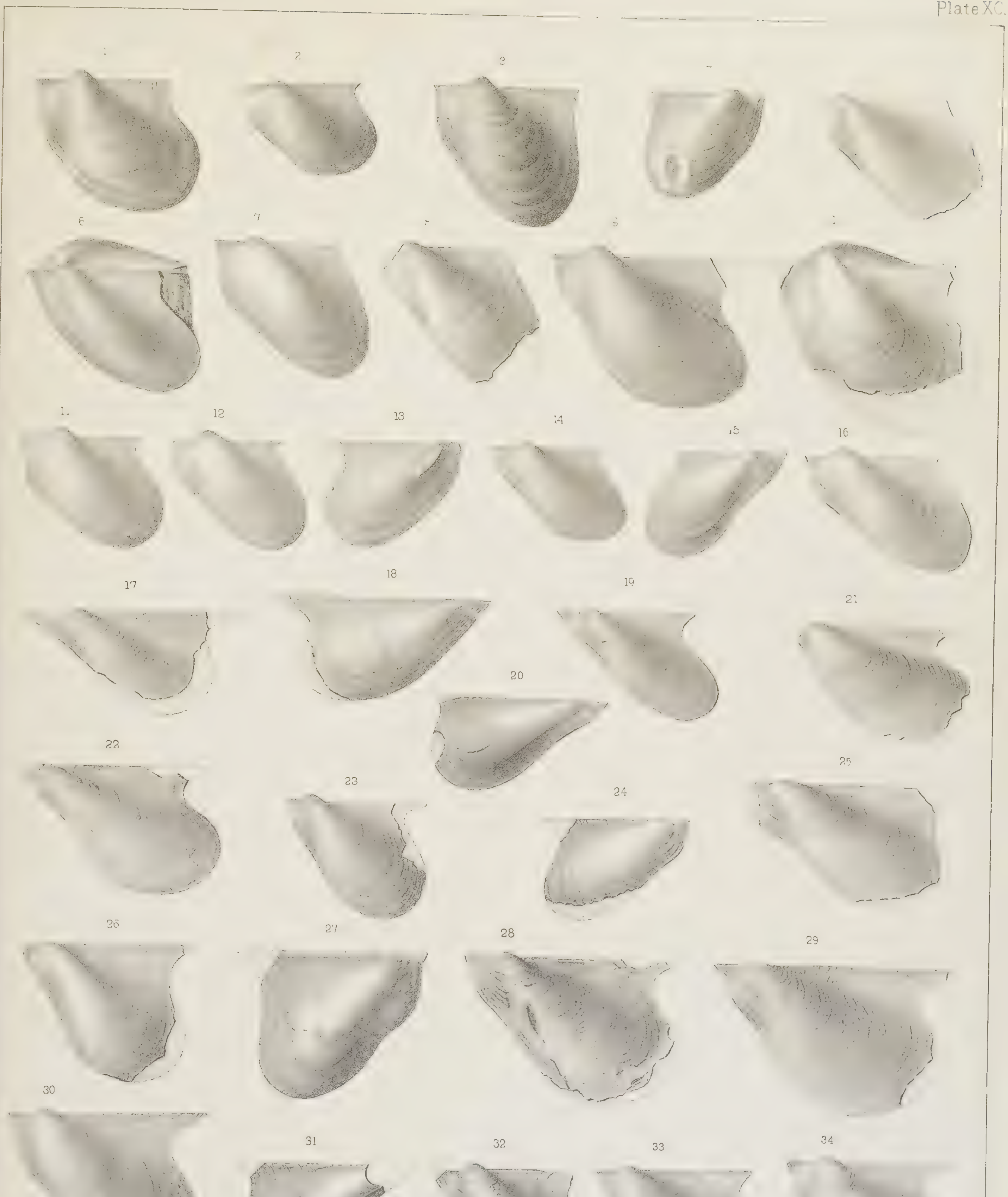

PLATE XCI.

c—Rostrata.

LEPTODESMA BITON.

Page 222.

Fig. 1. An imperfect left valve of this species.
Chemung group. *South of Smethport, Pa.*

LEPTODESMA ALIFORME.

Page 220.

See Plate 22.

Fig. 2. A large right valve showing the pallial line and muscular impression. This figure is given in correction of fig. 28 of plate 22.
Chemung group. *Angelica, N. Y.*

LEPTODESMA RUDE.

Page 221.

See Plate 25.

Fig. 3. The left valve described. This figure is given in correction of figure 12, plate 25.
Chemung group. *Near Smethport, Pa.*

LEPTODESMA JASON.

Page 213.

Fig. 4. A left valve of the medium size.
Chemung group. *Canton, Bradford Co., Pa.*
Fig. 5. A right valve somewhat imperfect, but preserving the form of the body and cardinal expansions.
Chemung group. *Near Mansfield, Pa.*
Fig. 6. A smaller right valve associated with the preceding.

LEPTODESMA LESLEYI.

Page 223.

Fig. 7. A large left valve showing the form and surface markings.
Chemung group. *Susquehanna Co., Pa.*

LEPTODESMA AVIFORME.

Page 224.

Fig. 8. An imperfect left valve.
Chemung group. *Tioga Co., Pa.*

d—Patulata.

LEPTODESMA FLACCIDUM.

Page 225.

Fig. 9. A left valve showing the characteristic form of the species.
Chemung group. *Lawrenceville, Tioga Co., Pa.*

LEPTODESMA PATULUM.

Page 226.

Fig. 10. An imperfect left valve.
Chemung group. *Mansfield, Pa.*
Fig. 11. A right valve.
Chemung group. *Mansfield, Pa.*

e—Arcoidea.

LEPTODESMA ARCIFORME.

Page 229.

Fig. 12. A large left valve.
Chemung group. *Mansfield, Pa.*

LEPTODESMA MACLURII.

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See Plate 25.

Fig. 13. A large left valve of this species. This figure is given in correction of fig. 13, plate 25.
Chemung group. *Near Smethport, Pa.*

Fig. 14. The right valve figured on plate 25, fig. 8, redrawn to correct the outline.
Chemung group. *Near Smethport, Pa.*

LEPTODESMA QUADRATUM.

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Fig. 15. The left valve described.
Chemung group. *Steuben Co., N. Y.*

LEPTODESMA PROPINQUUM.

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Fig. 16. A nearly entire left valve, showing the form and characters of the species.
Chemung group. *Mansfield, Pa.*

Fig. 17. A similar right valve.
Chemung group. *Mansfield, Pa.*

LEPTODESMA PHAON.

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Fig. 18. A left valve of this species.
Chemung group. *Mansfield, Pa.*

LEPTODESMA LICHAS.

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See Plate 21.

Fig. 19. A small left valve.
Chemung group. *Steuben Co., N. Y.*

Fig. 20. The left valve figured on plate 21, fig. 37, redrawn to correct the outline.
Chemung group. *Philipsburg, N. Y.*

f—Mytiloidea.

LEPTODESMA ACUTIROSTRUM.

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Fig. 21. The left valve described, showing the form of the body and the acute anterior end.
Chemung group. *Warren, Pa.*

LEPTODESMA MYTILIFORME.

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See Plate 25.

Fig. 22. The right valve figured on plate 25, fig. 7, redrawn to correct the outline and the form of the body.

Fig. 23. A small left valve.

Fig. 24. A view of left valve given in correction of fig. 11, plate 25.

Fig. 25. Two left valves as preserved on the surface of a piece of sandstone.
Chemung group. *Road from Olean to Smethport, Pa.*

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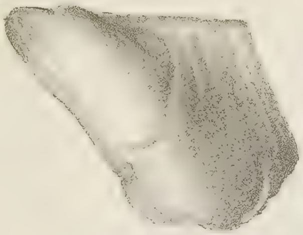

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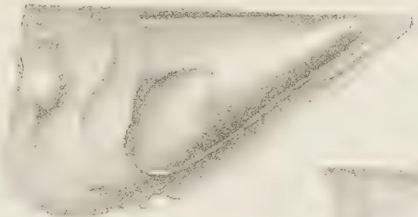

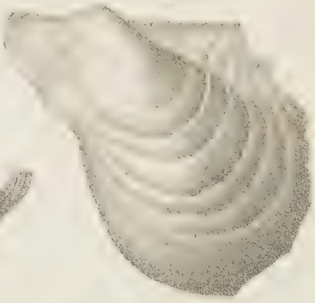

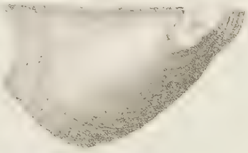

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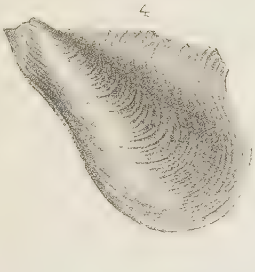

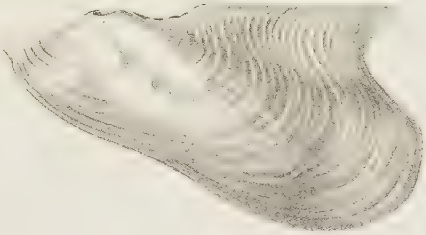

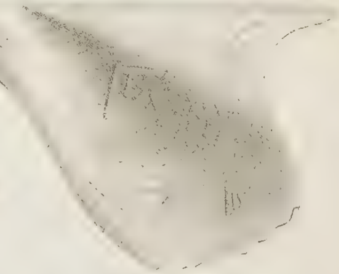

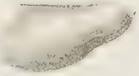

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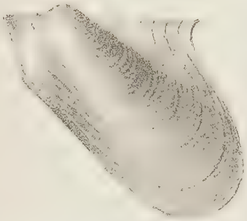

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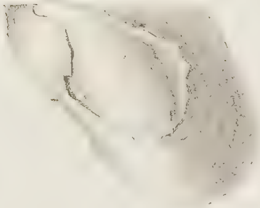

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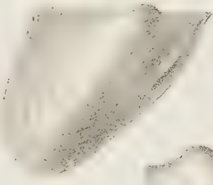

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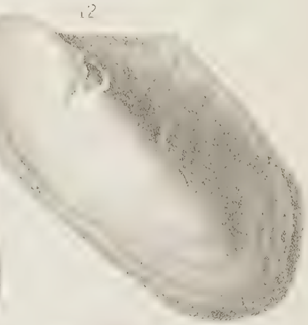

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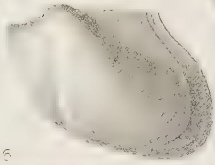

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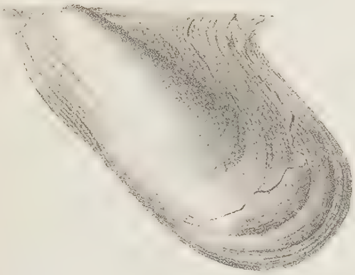

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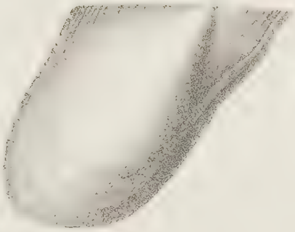

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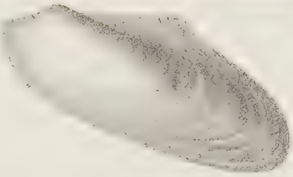

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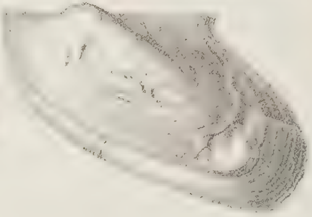

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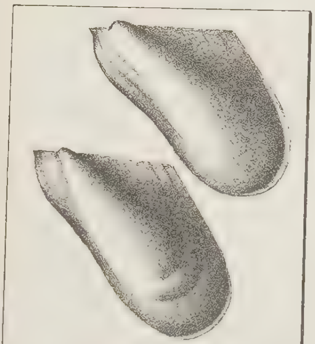

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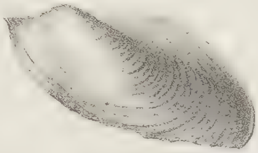

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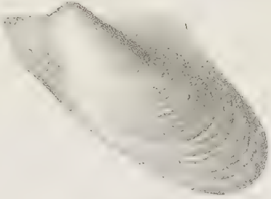

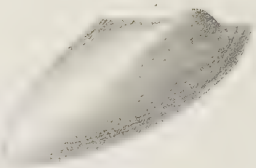

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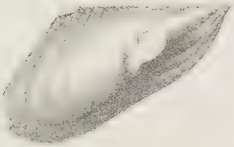

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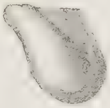

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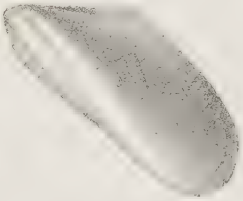

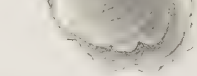

PLATE XCII.

LIMOPTERA CANCELLATA.

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See Plate 26.

Figs. 1, 2. Two small left valves differing in the frequency of the radii.
Hamilton group. *Falls of the Ohio.*

Fig. 3. The left side of the original specimen, redrawn to show the restored outline, the pallial line and muscular impression.
Hamilton group. *Falls of the Ohio.*

LIMOPTERA MACROPTERA.

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See Plates 24, 26, 27, 28 and 29.

Fig. 4. A small gibbous left valve showing numerous fine radii.
Hamilton group. *Delphi, Onondaga Co., N. Y.*

Figs. 5, 6. The right and profile views of a small specimen showing the form and convexity of the shell.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

Fig. 7. An outline of a large right valve.
Hamilton group. *Schoharie Co., N. Y.*

Fig. 8. A left valve preserving very marked surface characters.
Hamilton group. *Delphi, N. Y.*

Fig. 9. A right valve showing the marked radii on the umbonal region and their gradual obsolescence toward the margin of the valve. The hinge preserves the striated ligamental area, the oblique lateral teeth and three obscure cardinal folds anterior to the beak.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

LIMOPTERA OBSOLETA.

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See Plates 26 and 29.

Fig. 10. A large left valve, showing the form and surface characters and a portion of the ligamental area.
Hamilton group. *Pratt's falls, Onondaga Co., N. Y.*

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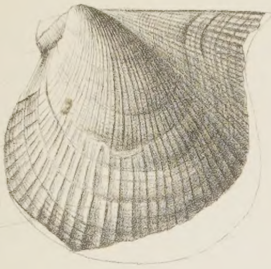

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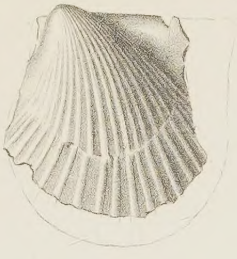

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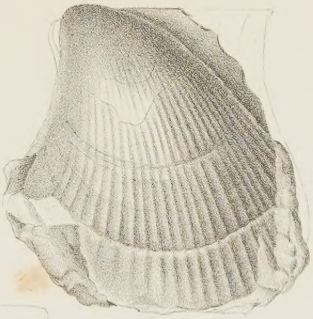

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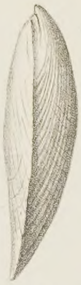

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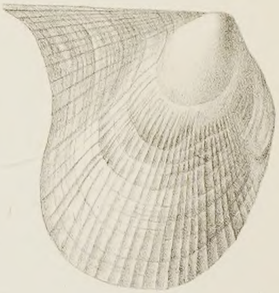

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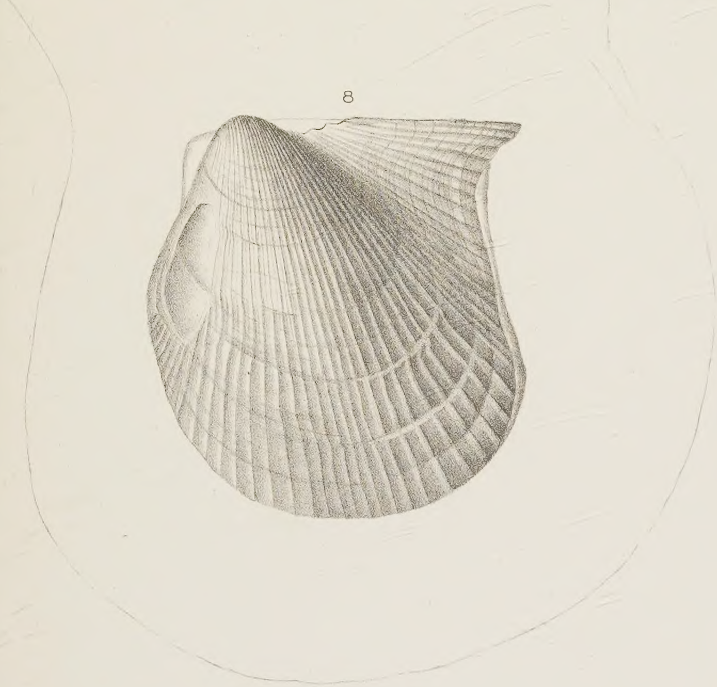

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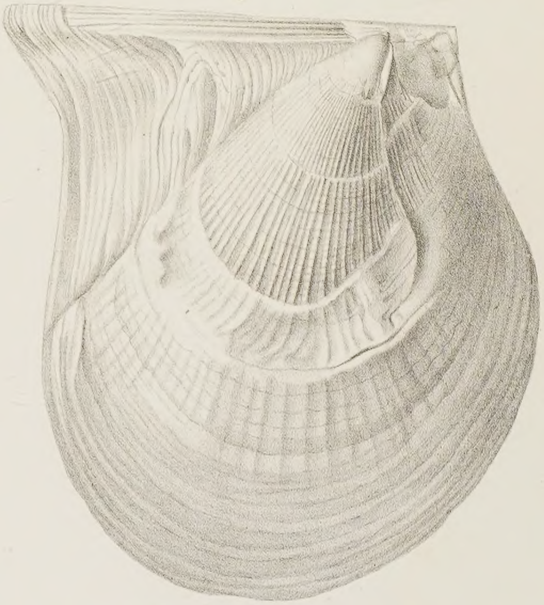

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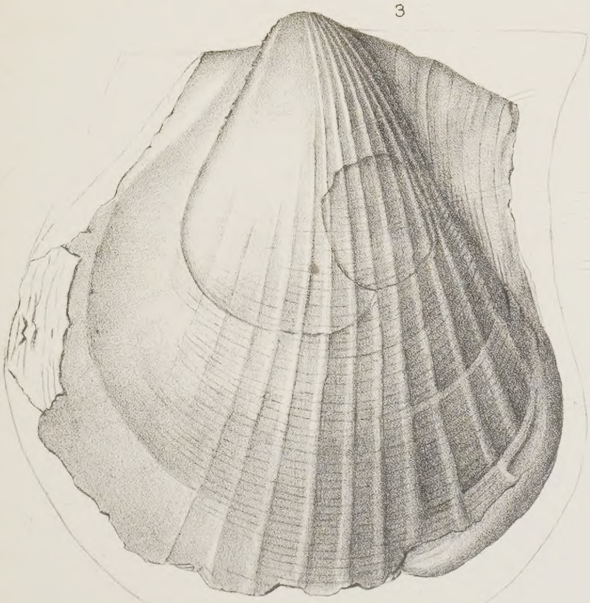

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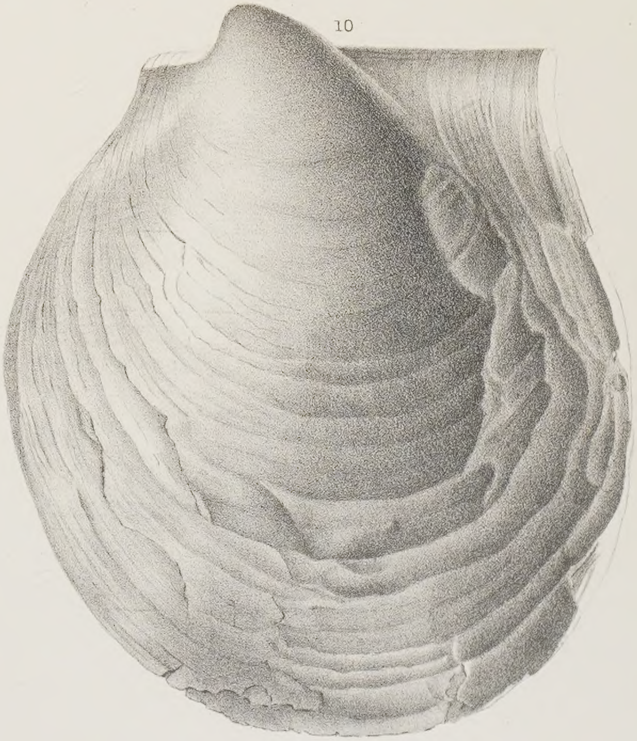

Emmons, del.

Chas Van Benthuysen & Sons, lith.

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